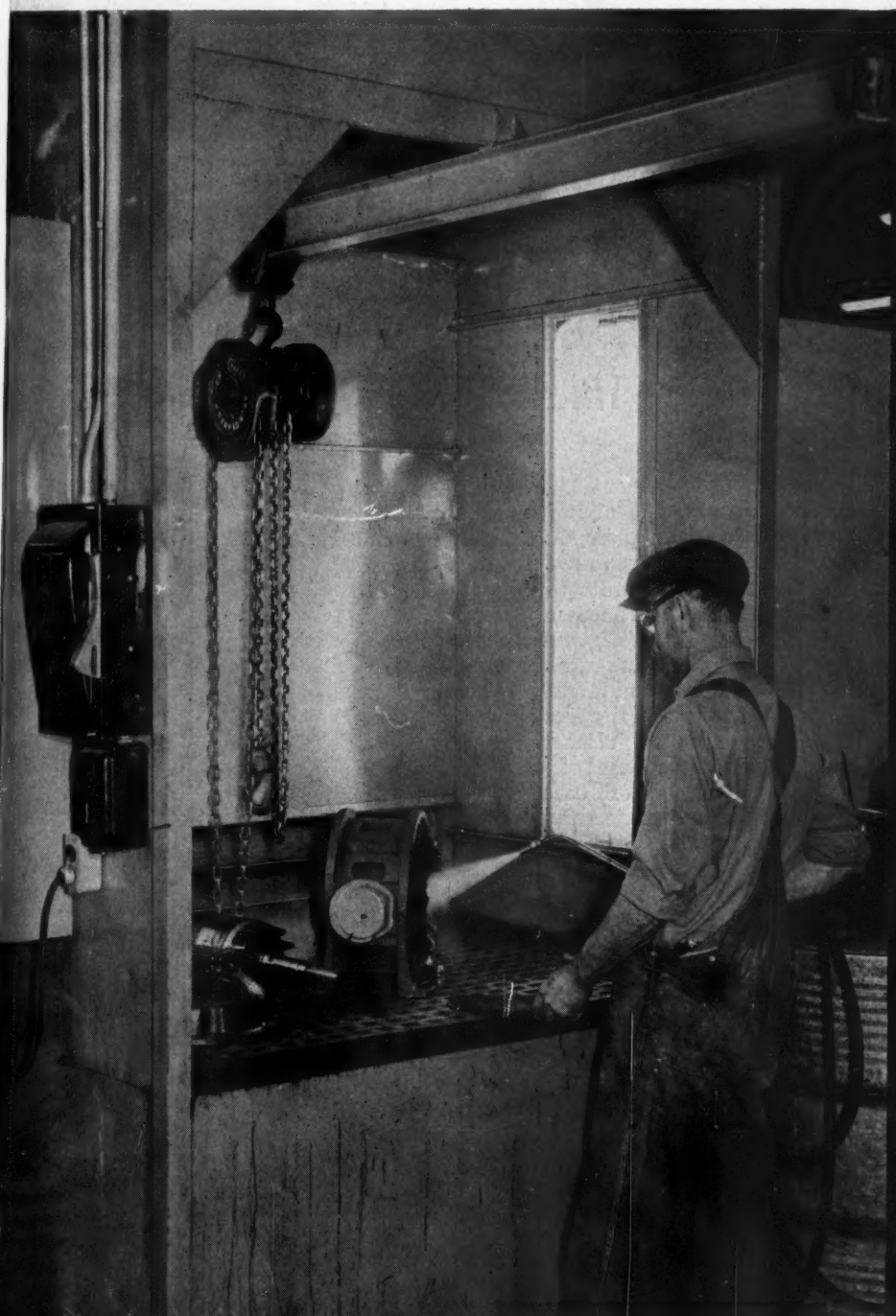
Electrical Contracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION & MAINTENANCE

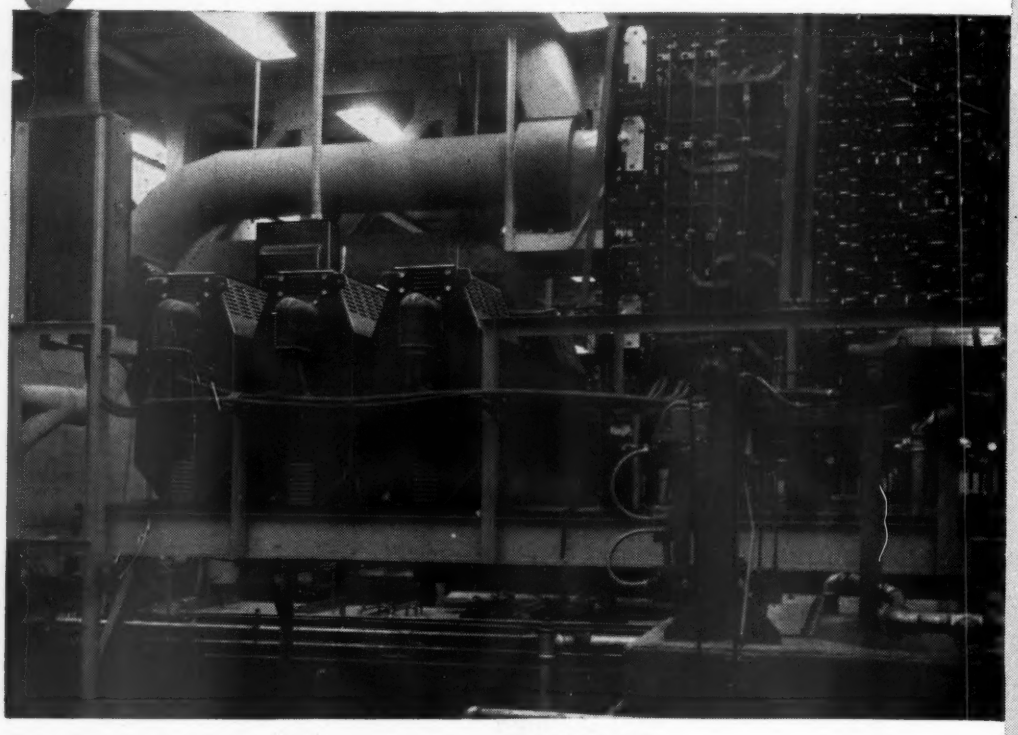


IN THIS ISSUE

Wiring a wind tunnel . . . estimating residential wiring ...lighting methods for restaurants . . . wiring to reduce anesthetic explosion hazards . . . infra-red heat in pottery manufacture... servicing electronic welder controls.

JULY · 1945

6 THINGS TO NOTICE in this picture



1. The dry-type transformers are close to the load, yet out of the way.
2. There are no long runs of heavy copper.
3. No expensive, space-stealing fireproof vaults are required.
4. The transformers are totally metal enclosed for safety.
5. Little installation space is used.
6. The slanted-louver construction, top and bottom, to assure cool operation. (The "chimney effect" produced by this construction carries away heat rapidly.)

THEY'RE ALL ADVANTAGES YOU CAN HAVE WITH

G-E TYPE D TRANSFORMERS

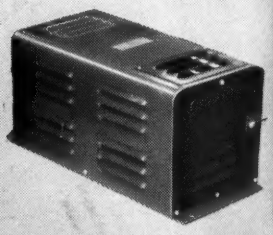
DO YOU REALIZE the many jobs on which you can use small G-E dry-type transformers to advantage? Insulating lighting circuits from power circuits, boosting low line voltage, and supplying the right voltage for the most economical operation of motors, machine tools, and welding apparatus are only a few of their many money-saving applications.

Stay cool; save space—Type D transformers are cooled by natural-draft ventilation. Their unique case construction aids the flow of ventilating air through the transformer coils. They can be installed against a wall or close to other units with little or no effect on the temperature rise of the transformer. Because of this fact, considerable space can be saved, especially when a number of these transformers are to be banked. (For example, the above installation in a midwestern plant. Here, only a small platform is required to take care of six 100-kva units to supply 230-volt annealing furnaces.)

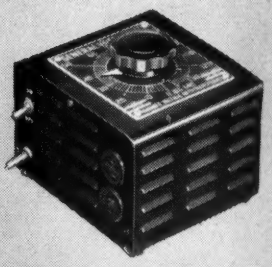
Easy to install; maintenance negligible—As these transformers are small, compact, and lightweight, and do not require a fireproof vault, they can be installed almost anywhere you wish. The ease of disassembly and reassembly of case parts permits quick inspection and cleaning, when necessary. Operating records show that little or no maintenance is required.

Type D transformers are available in ratings up to and including 100 kva—600 volts and below. For further information, ask for Bulletin GEA-897. *General Electric Company, Schenectady 5, N. Y.*

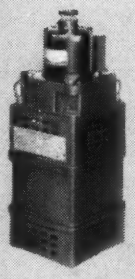
OTHER G-E AIDS TO BETTER VOLTAGE



VOLTAGE STABILIZER—Automatically provides a constant 115-volt supply to a given load, on circuits varying from 95 to 130 volts. Ratings from 50 to 5000 va. Ideal for precision laboratory or manufacturing processes, or built into such equipment as radio transmitters.



VARIABLE-VOLTAGE AUTO-TRANSFORMER — Provides smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243 to 810 va. Ideal for use in factories, laboratories, and assembled with other equipment.



AIR-COOLED REGULATORS—Automatic type: for secondary circuits (10% regulation, raise and lower). Remote-motor or hand operated: for laboratory or testing (100% raise and lower). Ratings up to 12 kva, 600 volts.

THE RIGHT VOLTAGE AT THE RIGHT PLACE DOES THE JOB **BETTER**

GENERAL ELECTRIC

403-80-5205, 5400

"A FIRST CLASS INSTALLATION", *say electricians*

(*and they also say,* "SO EASY TO PUT IN")

Arc-quenching construction in 2, 3 and 4 Pole, 30, 60 and 100 Ampere Safety Switches.

SKETCHED above is the switch block from a Murray Single Throw, Fusible, Type D, Safety Switch. In the circle is the outstanding feature — the double break blade and arc quenching chamber. Each blade is provided with a double break — the arc is broken into two parts. The burning is greatly reduced by this feature. Whatever arc is formed at each of the two breaks is drawn into a narrow slot in the mounting base where it is lengthened-out and cooled — the effects co-acting to quench the arc almost instantly. This arc-quenching construction coupled with those Murray Switch characteristics as ample wiring room, properly placed knockouts, good-looking cabinets, assure the electrician the satisfaction that comes from a first-class installation. Metropolitan Device Corporation, Brooklyn, New York.

Write for the facts — no obligation!

Murray

SAFETY SWITCHES

THERE ARE MURRAY JOBBERS EVERYWHERE

Keep On

BUYING WAR BONDS AND STAMPS

ELECTRICAL CONTRACTING. Published monthly, price 25 cents a copy. Vol. 44. No. 7. Allow at least ten days for change of address. RETURN POSTAGE GUARANTEED. Publication Office, 99-129 N. Broadway, Albany 1, N. Y. All communications about subscriptions should be addressed to the Director of Circulation, Electrical Contracting, 330 West 42nd St., New York 18, N. Y. Subscription Rates—U. S. A. and Latin American Republics, $2.00 a year, $3.00 for two years, $4.00 for three years. Canada $2.50 a year, $4.00 for two years, $5.00 for three years. Great Britain and British Possessions, 18 shillings for one year, 36 shillings for three years. All other countries $3.00 a year, $6.00 for three years. Please indicate position and company connection on all subscription orders. Entered as second-class matter August 29, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879. Printed in U. S.

Copyright 1945 by McGraw-Hill Publishing Company.

Cable address: "McGraw-Hill, New York." Member A. B. P. Member A. B. C.

PROTECTION *Starts* HERE

APPLETON
EXPLOSION-PROOF EQUIPMENT
Gives a Wide Margin of Safety

No chance for arcs to cause explosions or fires—in chemical plants, powder mills, oil-refineries, rubber plants, and other hazardous locations—with Appleton Explosion-Proof Fittings, and Receptacles and Plugs, to seal in all danger in every type of installation.

Rugged, heavy-duty Appleton Explosion-Proof equipment—cast of tough *malleable iron*—assures safe, dependable, efficient operation. The complete Appleton line, which includes Dust-Tight and Vaportight fittings and fixtures as well as Explosion-Proof, offers exactly the right fitting for every job. All conform to exacting code requirements, are approved by Underwriters' Laboratories.

Save time, insure permanence by specifying Appleton fittings —"STANDARD FOR BETTER WIRING"—for hazardous locations and all other conduit jobs.

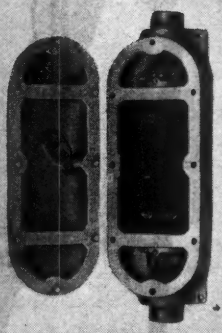
Sold Through Wholesalers

APPLETON ELECTRIC COMPANY
1704 WELLINGTON AVE., CHICAGO 13, ILL.

Branch Offices: NEW YORK, 76 Ninth Ave. • DETROIT, 7310 Woodward Ave. • CLEVELAND, 1836 Euclid Ave. • SAN FRANCISCO, 655 Minna Street • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Ave. • ATLANTA, 203 Luckie St., N. W. • BIRMINGHAM, 6 N. Twenty-first Street • MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 418 Bessemer Bldg. • BALTIMORE, 100 E. Pleasant St. • BOSTON, 10 High St. • DENVER, 1536 Sixteenth St. • PHILADELPHIA, 1217 Race St.

Resident Representatives: Cincinnati, Dallas, Kansas City, Milwaukee, New Haven, New Orleans, Seattle

APPLETON ELECTRIC A PRODUCTS REG. U.S. PAT. OFF.



Type ARTC—"SEAL-I Explosion-Proof C Breaking Switch Unile left). Cover removed to roomy wiring chambers center switch chamber lated in approved explo proof method.

Type OFC Unilet, Explo sion-Proof, Dust-Tight Oil-Immersed or Air-Break momentary switch Removable close-up plug for either dead-en or through-feed wiring

Type FSQX Explosion-Proof and Dust-Tight Receptacle with Interlocking Safety Switch and Type FP Plug.

IN THE COMPLETE APPLETON LI of Explosion-Proof, Dust-Tight, and Vaportight eq ment are dead-end receptacles, switches of m types, lighting fixtures—everything for comp plant protection, including the first and only Ex sion-Proof fluorescent Lighting Fixture.

APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

Electrical Contracting

Contents for July, 1945

July—*at a glance* 55

Future Manpower—*An Editorial* 57

We Wired a Wind Tunnel 59

By GEORGE B. STONE—How an electrical contractor tied in with a $2,500,000 project.

Estimating Residential Wiring 64

By RAY ASHLEY—A description of the "Four Unit System" for estimating residential wiring.

Lighting Techniques for Restaurants. 69

By BERLON C. COOPER—A discussion of new lighting techniques for restaurants and public dining areas.

Safety in the Operating Room 72

By GLENN ROWELL—How explosions from electrical causes can be controlled in operating rooms.

Potteries Save With Infra-Red 75

Drying time and curing cut with open rack type infra-red oven in pottery manufacturing.

Exposed Fluorescent Office Lighting. 78

Parallel lines of reflectorless cold cathode fluorescent tubes will illuminate the new engineering and office areas in a Detroit industrial plant.

Industrial Electrification 97

Paraleling D-C Generators—II

Departments

Practical Methods 80
Equipment News 89
Data Sheets....87, 104, 108
Reader's Quiz 110
Motor Shops 121
Modern Lighting 129
Electronics 141
Questions on the Code...155
In the News.....163
Manufacturers News ...193
Advertisers' Index 206

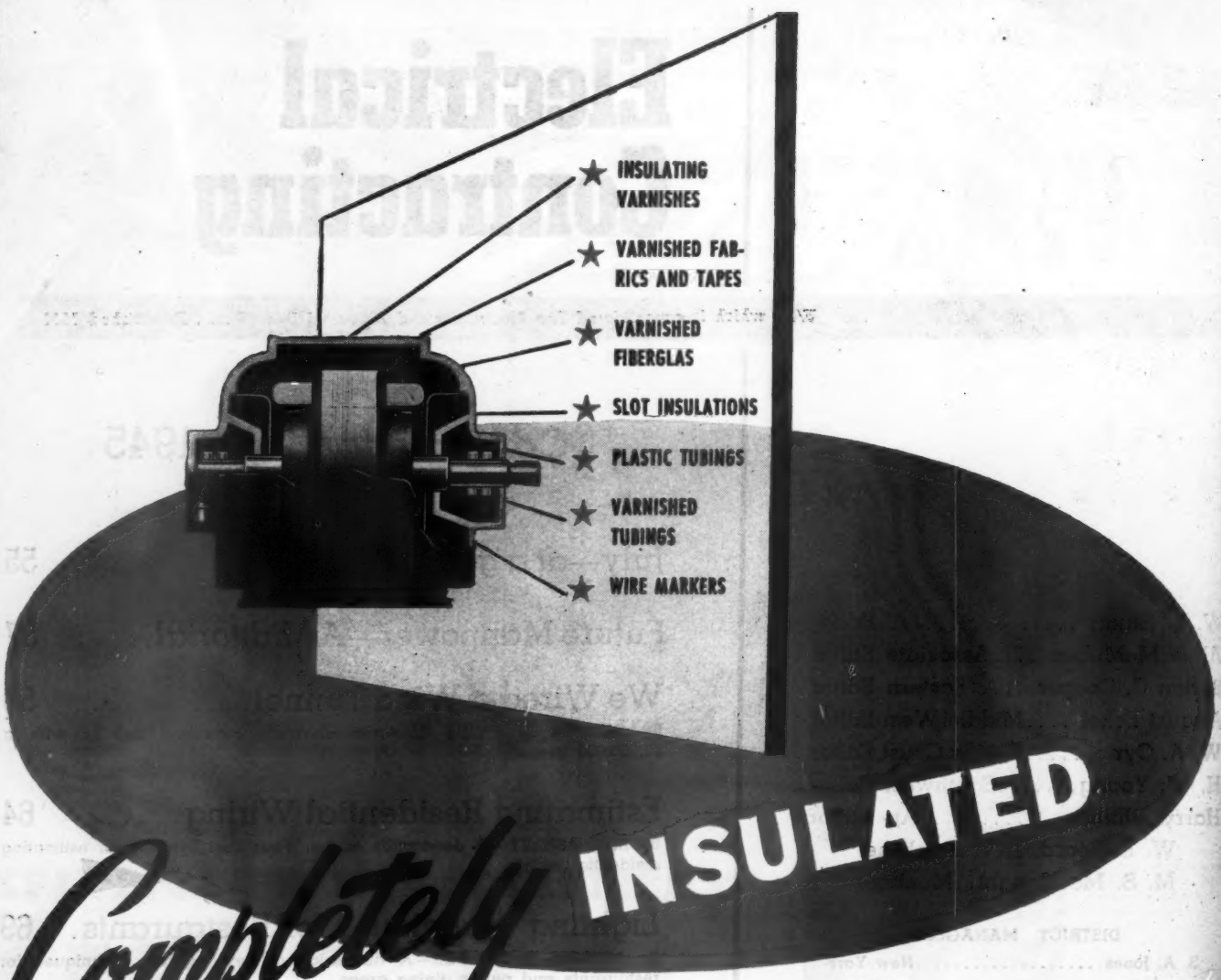
W. T. Stuart .....Editor
Alice McMullen ....Associate Editor
Berlon C. Cooper.....Eastern Editor
August Eckel ....Middle West Editor
W. A. Cyr .....Pacific Coast Editor
H. W. Young.....Southwest Editor
Harry Phillips .....Art Editor
W. K. Beard, Jr....Publisher
M. S. MacNaught..Manager

DISTRICT MANAGERS

S. A. Jones.....New York
F. J. Seiler .....Cleveland
W. B. Heaps.....Chicago
A. B. Conklin, Jr.....On Leave U. S. Army

McGRAW-HILL PUBLISHING COMPANY, INC. JAMES H. McGRAW, Founder and Honorary Chairman; JAMES H. McGRAW, Jr., President; CURTIS W. McGRAW, Senior Vice-President and Treasurer; HOWARD EHRLICH, Vice-President (for business operations); JOSEPH A. GERARDI, Secretary-editorial operations); JOSEPH A. GERARDI, Secretary; J. E. BLACKBURN, Jr., Director of Circulation. Publication Office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive Offices, 330 W. 42nd St., New York 18, N. Y. *Branch Offices:* 520 North Michigan Ave., Chicago 11; 68 Post St., San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia 2; Cleveland 15; Detroit 26; St. Louis 8; Boston 16; Atlanta 3; Los Angeles 13; Pittsburgh 22; Member A.B.C. Member A.B.P.

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management in the field of electrical construction and maintenance.



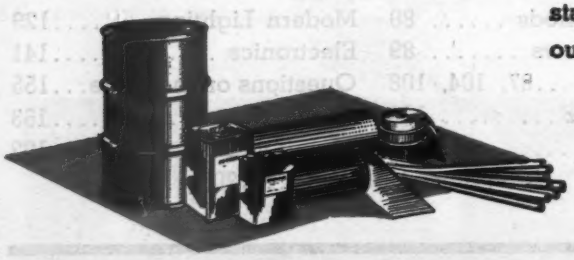
Completely INSULATED

by the Leader in Insulation!

Motor manufacturers have come to the realization that the specification "Completely Insulated by Irvington" means longer motor life with less chances of electrical failures. Basic to this is the fact that every Irvington insulation has been formulated to produce definite and outstanding characteristics — resistances to the agents of motor destruction — heat, corrosive fumes, excessive moisture etc. Insulations have been designed for regular and unusual motor needs — matched to work with each other for blended, smooth acting motor performance — to produce long-lasting and dependable motors. From this one source, *Irvington*, you can obtain insulations not only for motors but for all other electrical equipment as well. Each and every product is kept to Irvington's high standards by strict laboratory and production control. We offer our cooperation and invite your inquiries. Write Department 96.

IRVINGTON PRODUCTS include:

Core Plate, Finishing and Sticking Varnishes • Varnished Canvas and Duck • Varnished Nylon, Rayon and Silk • Varnished Papers • Insulating Punchings • Fibron Plastic Tapes • Cardolite Compounds



IRVINGTON
VARNISH & INSULATOR COMPANY
Irvington 11, New Jersey, U. S. A.

How Allis-Chalmers Engineering Discovers New Ways to Build Better Motors for You.

WANTED: D-C Motors to Dive for Navy!

BUILD SUBMERSIBLE MOTORS to run 25 feet under water — and build 'em to run that way 90 days at a stretch! That's the tough assignment Navy engineers turned over to Allis-Chalmers.

Those motors had to: 1) withstand sea pressure; 2) stay waterproof; 3) be light in weight.

No. 1 problem was . . . *how to build water-tight casings.* A-C engineers experimented, found the solution in fabricated steel.

Quickly, individual casing parts were built. Subsequent hydrostatic tests applied to them showed molecular arrangement and carbon content of steel to be ok. Result —only a heavy weld between fabricated parts was needed to assure water-tightness!

Now the going was easier. For adequate surface seal, field yokes of one-inch rolled steel were used. End housings were reinforced. Exposed adjustments were made leakproof. Then . . . minor changes in insulation, at other points, and the problem was solved.

* * *

"What's all this got to do with *my* problems?" you may ask. Just this . . . Everytime A-C tackles the job of building special motors for extra-tough war applications, like this one, it also discovers important new ways to build better *standard* motors for you!

That's why you hear it said so often, *"You can depend on Allis-Chalmers Motors!"* ALLIS-CHALMERS, MILWAUKEE, WIS.

A 1889

You Can Depend on ALLIS-CHALMERS Motors

now your Big drives

NEW 2000-hp INDUCTION MOTOR LARGEST MEMBER OF TRI-CLAD FAMILY

Dwarfing the original Tri-Clad motor (resting on the conduit box) in size, this new 2000-hp "big brother" embodies all the same protective construction features.

It operates at 1800 rpm, on 2300 volts, 60 cycles. This new 3-phase motor is in the 6360-frame series, which is five steps larger than the largest standard industry frame size (namely 505).

*THE EXTRA TRI/CLAD

REG. U.S. PAT. OFF.

Special motors can be custom built in Tri-Clad design for *your* problem

Your exceptional drive requirements may call for an induction motor specially designed to the job. Whatever its rating, it can generally be built with many of the Tri-Clad motor's strong points, such as enclosed upper portion, smooth cast-iron end shields, windings of Formex wire, and double-end ventilation.

General Electric's special motor engineering has produced the world's fastest motor, the world's strongest motor, and many other tradition-breaking designs. We'll welcome your unusual problems.

HERE'S TODAY'S WIDER RANGE OF STANDARD SIZES	
TRI/CLAD **Type K**	**1 hp to 2000 hp at 1800 rpm**
TRI/CLAD **Type KG** (High starting torque, low starting current)	**5 hp to 200 hp at 1800 rpm**
TRI/CLAD **Type KR** (High starting torque, high slip)	**Available to 100 hp in speeds required for high-slip flywheel drive (punch press, etc.)**

TRI/CLAD MOTORS

Buy all the BONDS you can—*and keep all you buy*

can have it, * *too*

PROTECTION OF CONSTRUCTION

G-E STANDARD Tri-Clad Induction Motors Now Available to 2000 hp

For that important *big* drive (up to 2000 hp, 1800 rpm) you can now get a G-E standard Tri-Clad induction motor. All the protective features that have proved so valuable to service continuity and long life in the more widely used sizes are included:

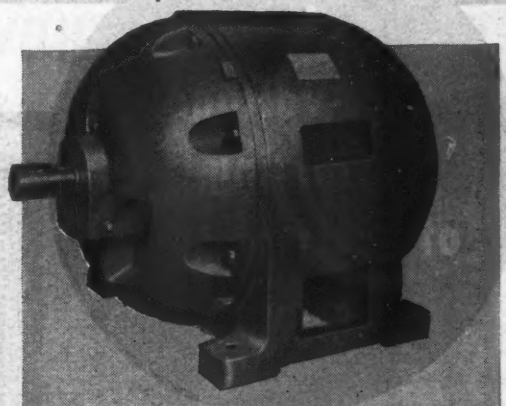
EXTRA PROTECTION FROM PHYSICAL DAMAGE—Cast-iron construction with upper portion completely enclosed to keep out falling objects, dripping liquids. Streamline, cast-iron end shields. Corrosion-resisting finish.

EXTRA PROTECTION FROM ELECTRICAL BREAKDOWN—Windings of Formex* wire are solidly bonded with synthetic resins strongly resistant to heat, oil, and moisture. Formex wire insulation stands up strongly under abrasion or "heat-shock."

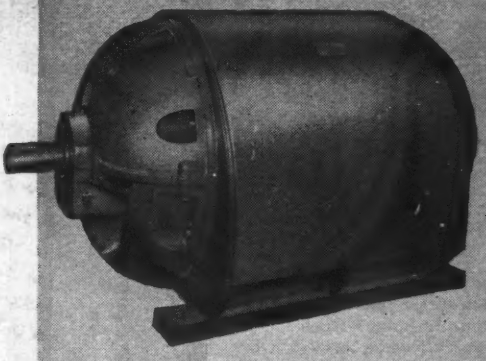
EXTRA PROTECTION FROM OPERATING WEAR AND TEAR—Available with either sleeve or ball bearings—in dust-tight housings. Sleeve-bearing design is a further refinement of well-proved Tri-Clad motor bearing proportions, efficiently lubricated, with "air seal" to insure oil tightness of the housing.

The Tri-Clad, in its wide range of types and sizes, is G.E.'s most widely used (integral-hp) motor. Chances are that there's a Tri-Clad to meet your requirements "on the nose." For information on General Electric's complete line of Tri-Clad motors, ask for GEA-3580. *General Electric Company, Schenectady 5, N. Y.*

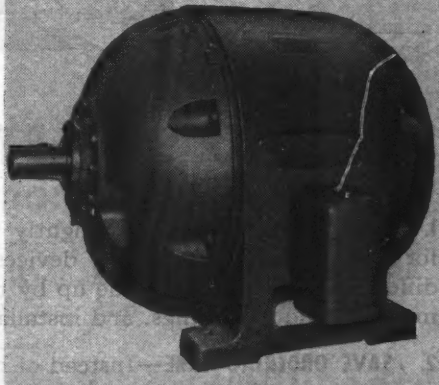
*Trade-mark reg. U.S. Pat. Off.



Typical large-size sleeve-bearing Tri-Clad polyphase motor, now standard up to 2000 horsepower.



Modified cast-iron frame construction used for certain large sizes of the extended Tri-Clad motor line.



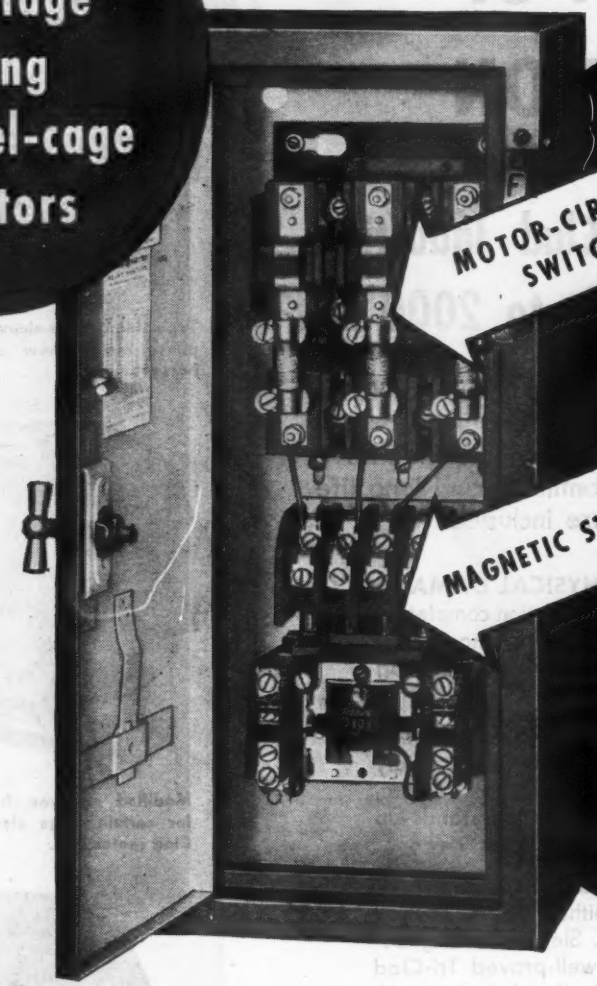
Separable housing construction used for large-size ball- or roller-bearing Tri-Clad motors. Roller bearings are standard at coupling end.

GENERAL ELECTRIC

MOTOR STARTERS

for full-voltage starting of squirrel-cage a-c motors

★ DEPENDABLE ★ ATTRACTIVE IN APP



TWO DEVICES IN ONE UNIT

6 WAYS TO SAVE BY USING COMBINATION STARTERS

1. **SAVE MONEY**—List price slightly more than for two separately mounted devices, but the difference is more than made up by the savings in wire, conduit, fittings, and installation costs.

2. **SAVE ORDERING TIME**—Instead of buying two separately mounted devices, you buy one factory co-ordinated unit that controls and protects your motor.

3. **SPEED UP INSTALLATION**—Users report a 50 per-cent reduction in mounting time, a 40 per-cent reduction in wiring time, as compared with the installation of two separate devices. You connect to only 9 terminals—not 15.

4. **SAVE WALL SPACE**—You can mount combination starters in small, unused places either near to or remote from the operator.

5. **CONSERVE MAN POWER**—By eliminating one complete mounting job on every installation, you save valuable man power.

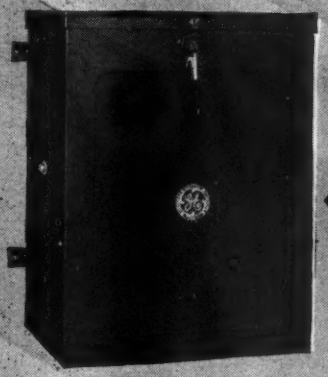
6. **SAVE CRITICAL MATERIALS**—Combination starters have less copper wire, steel conduit, and fittings than separately mounted devices.

—AND THEY SAVE YOUR MOTORS, TOO. The fuses, or the breaker, are co-ordinated with the thermal overload relays to give complete motor protection under short-circuit or overload conditions.

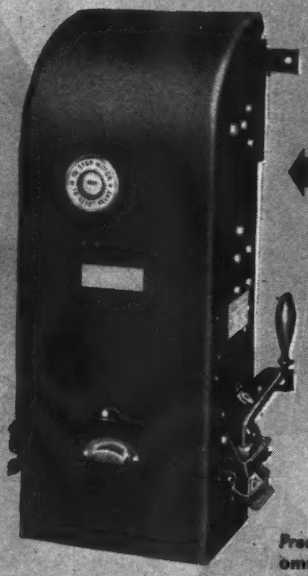
EVERY TYPE, EVERY SIZE, FOR EVERY MACHINE APPLICATION

IN APPEARANCE ★ DESIGNED TO BLEND WITH MODERN MACHINES

Manual and Magnetic Starters

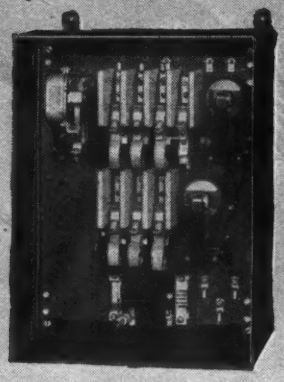


Reduced-voltage Magnetic Starter—These starters are recommended for poly-induction phase motors driving pumps, conveyors, compressors, etc. Available in ratings from 5 to 900 hp at all standard voltages and frequencies.

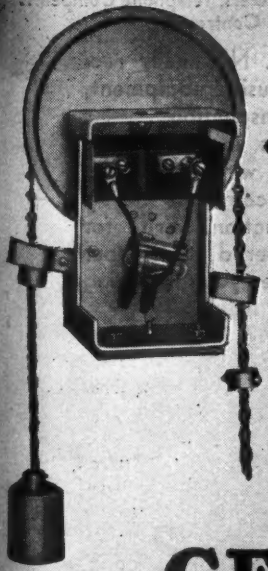


Reduced-voltage Magnetic Starter—These starters are recommended for poly-phase induction motors driving pumps, conveyors, compressors, etc. Available in ratings from 5 to 900 hp at all standard voltages and frequencies.

Primary-resistor Magnetic Starter—Well adapted for squirrel-cage induction motors on geared or belted drives where a sudden application of full-voltage torque must be avoided. Although the magnetic starter shown is of the general-purpose type, other enclosures are available for different operating conditions.



Accessories



Float Switch—Suitable for use in the control circuit of a-c or d-c automatic starters, and can directly handle the circuits of small motors. All float switches are drippproof and splashproof, and are suitable for outdoor installation when they are not subjected to snow or sleet.

Pressure Governor—Recommended for the automatic control of motor-driven pumps, air compressors, and similar applications. The governor is designed to handle the control circuit of any standard G-E d-c or a-c automatic starter rated up to and including 300 amperes. Above 300 amperes, it is necessary to insert a control relay.

WHAT IS YOUR APPLICATION?

G-E starters come in a variety of enclosures to meet any operating conditions in your plant. We'd like to send you any additional information you may want. And, remember, our engineers will be glad to help you select the correct type of starter for your needs. *General Electric Company, Schenectady 5, N. Y.*

INDUSTRIAL CONTROL

Buy all the BONDS you can—and keep all you buy.

GENERAL ELECTRIC

670-139-8916

Thermoplastic insulation specialists . . . producing a complete line from fine wires to heavy power cables . . . serving: Public Utilities, Radio, Electronic, Appliance and Instrument Manufacturers, Telephone Companies and Contractors.

There is no substitute for engineering. Nationally recognized engineering talent . . . PLUS exclusive equipment, careful materials control, and exacting inspection . . . . explain PLASTIC'S amazing achievements in the design and production of thermoplastic insulated wire and cable. This engineering "know how" is at your command . . . . for today's planning or tomorrow's production. Write for complete information and samples engineered to fit your particular requirements. Remember . . . when you're thinking of PLASTIC you're thinking of US!

PLASTIC

WIRE & CABLE *NORWICH CONN*

CORPORATION

Type WMK Enclosed Safety Switch

CONDULETS

are rain-tight. You can use them in both indoor and outdoor locations.

Safety. Positive interlock prevents opening the case unless switch is "off." Dead front switch is held in "off" position while case is open.

Switches. Quick make and break mechanism. Double break, reinforced, positive pressure-type blade and jaw construction. Positive pressure fuse clips. Combination solder or solderless wire lugs.

Cast metal case. Strong and durable. Four sturdy mounting feet. Many possible threaded hub arrangements for both vertical and horizontal conduit. Cover may be padlocked to prevent unauthorized entry. Operating handle may be padlocked "on" or "off."

Permanent lubrication in the threaded operating shaft bearings resists corrosion and prevents the entrance of dust and moisture.

Horsepower ratings. 2 through 50-H.P. 30, 60, 100 or 200-ampere. 230-575-volt A.C. 250-600-volt D.C.

Listed in Condulet Catalog No. 2500, Section 50, Page 20.

(CONDULETS are made only by CROUSE-HINDS)

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
Syracuse 1, N. Y., U.S.A.

Offices: Birmingham—Boston—Chicago—Cincinnati—Cleveland—Dallas—Denver—Detroit—Houston—Kansas City—Los Angeles—Milwaukee—Minneapolis—New York Philadelphia—Pittsburgh—San Francisco—Seattle—St. Louis—Washington. *Resident Product Engineers:* Albany—Atlanta—Buffalo—Charlotte—New Orleans
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

Shock Troops!

EXPENDABLE—but giving FULL LIMIT protection

Economy Fuses, with Economy's "Drop-Out" Renewal Links, are the "Shock Troops" which protect the main army of electrical devices, instruments and equipment . . . *expendable* when danger threatens, yet strong enough to give *full limit* safety before blowing . . . thus eliminating costly, needless current interruptions.

Economy "Drop-Out" Renewal Links are inexpensive . . . quickly and easily replaced . . . give consistent protection at full rated capacities.

Representatives in all principal cities . . . SOLD THROUGH JOBBERS EXCLUSIVELY SINCE 1911. First to be approved by Underwriters' Laboratories.

Economy pioneered in fuse invention and development, and has constantly improved the quality, performance and dependability of Economy Fuses and "Drop-Out" Renewal Links.

Protection with ECONOMY

Cartridge Type
0-600 Amps. 250 Volts
0-600 Amps. 600 Volts

Plug Type
3-30 Amps. 125 Volts

Protection WITH ECONOMY

TIME-TESTED • RELIABLE • SAFE

ECONOMY Fuse and Mfg Co.

2717 Greenview Ave., Chicago 14, Illinois

1038

THE SECOND RING DOES IT!

KILLARK 2-RING *Thinwall* FITTINGS

The first engages
The second locks and seals
SAVES THREADING LABOR
GIVES DOUBLE SECURITY

Easier to install, Killark 2-Ring Thinwall Fittings, provide maximum gripping and perfect sealing in record time.

The *first ring*, the "engagement" ring forms a wedged seat for the notched "wedding" ring which locks and seals as the "hex" nut is tightened.

Threading of conduit is eliminated through the use of the Killark 2-Ring Thinwall Fitting. Saw the conduit, insert into the conduit body hub, a few hand twists of the "hex" nut and the wrench does the rest to make a permanent, dustproof rigid fit.

This new Killark fitting comes in sizes for ½" to 2" pipe size. *Another Killark fitting to improve the installation job!*

This is but one of the thousands of fittings in the COMPLETE KILLARK LINE of Conduit Bodies, and Fittings, Explosion-proof and Vaporproof Fittings and Lighting Fixtures. Do you have a complete Killark Catalog? Send for it.

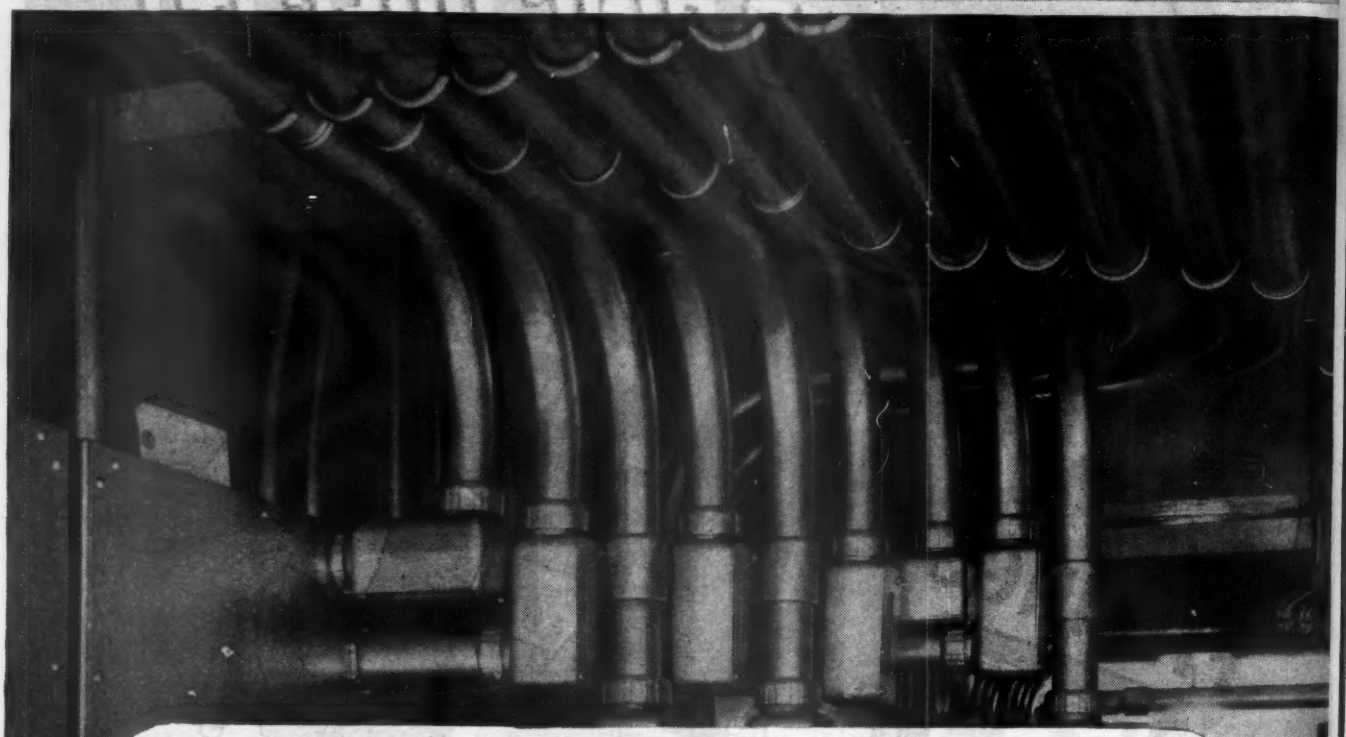
KILLARK ELECTRIC MANUFACTURING COMPANY

KILLARK ST. LOUIS

Vandeventer & Easton Aves.
ST. LOUIS 13, MO.

BRANCHES: Offices and Warehouses: Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, Utica.
Offices: Cincinnati, Cleveland, Dallas, Kansas City, Minneapolis.

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*



Smart Post-War Planning Demands SAFE Wiring Methods

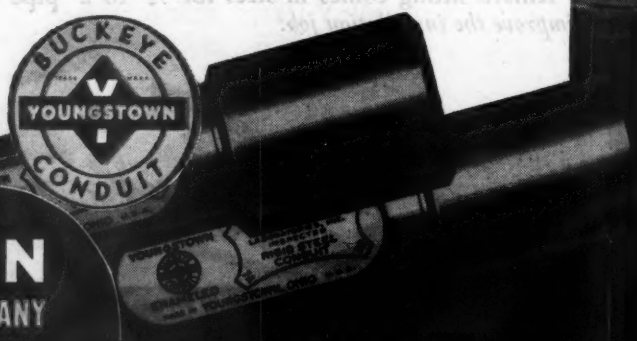
A double responsibility confronts the electrical industry:

1. The obligation to replace makeshift, unsafe wiring systems, installed according to "must do" emergency ideas, forced on industry by war time shortages and regulations.
2. The duty to install only assuredly safe wiring systems in all new post V-Day construction.

Remember this: The only wiring system approved by the National Electrical Code as moisture, vapor, dust and explosion proof in hazardous locations is a standard-threaded rigid conduit.

With standard-threaded rigid steel conduit, such as Youngstown's Buckeye, again available through distributors, there is no reason not to provide dependable wiring protection.

Wherever there is moisture, or vapor, or excessive vibration, or possibility of corrosion, or accumulating dust and dirt, or danger of crushing or other mechanical injury, specify and use Youngstown Buckeye Conduit.



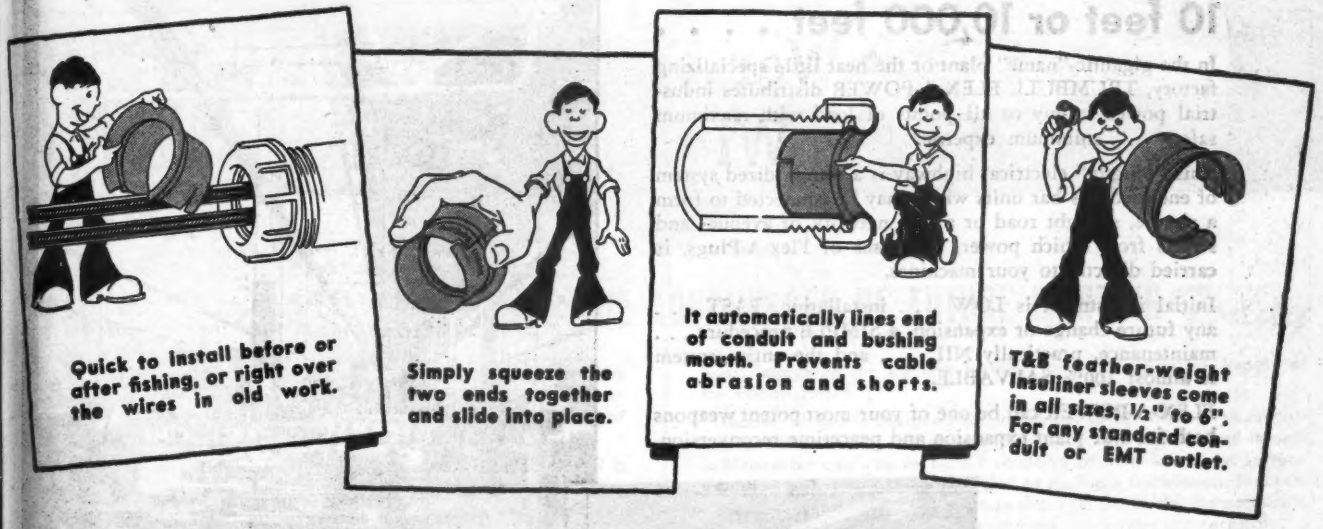
YOUNGSTOWN
THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN, OHIO
Manufacturers of
CARBON · ALLOY AND YOLOY STEELS

Ask your distributor for:
Youngstown Buckeye Conduit · Pipe and Tubular Products · Sheets · Plates · Electrolytic Tin Plate · Coke Tin Plate · Bars · Rods · Wire · Nails · Tie Plates and Spikes

All right, it is magic

In a split second snap of your fingers you can convert *any* cable outlet into a Code-Approved† insulated bushing at next to no cost.

"Insuliner"* SLEEVES DO THE TRICK


Quick to install before or after fishing, or right over the wires in old work.
Simply squeeze the two ends together and slide into place.
It automatically lines end of conduit and bushing mouth. Prevents cable abrasion and shorts.
T&B feather-weight Insuliner sleeves come in all sizes, ½" to 6". For any standard conduit or EMT outlet.

With Insuliner Sleeves in stock, your present conduit bushing stock will immediately service any insulated bushing requirement.

Under the T&B Plan, Insuliner Sleeves, like all other T&B wire fittings, are sold exclusively through the service organizations of T&B Electrical Wholesalers.

* Trademark Reg. U. S. Pat. Off.
* Patented.
† See N.E. Code ¶ 3012-b.

THE THOMAS & BETTS CO.
INCORPORATED
manufacturers of electrical fittings since 1898
ELIZABETH 1, NEW JERSEY
In Canada Thomas & Betts Ltd. Montreal

THERE IS NO SUBSTITUTE FOR ENGINEERING

TRUMBULL

FLEX-A-POWER

BIG BUSINESS *and* LITTLE BUSINESS BOTH ENJOY THE BENEFITS OF FLEX-A-POWER FEEDER DISTRIBUTION SYSTEM

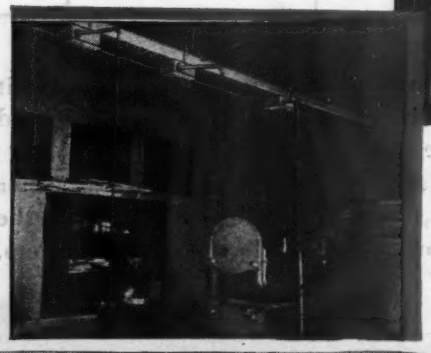
10 feet or 10,000 feet . . . .

In the gigantic "name" plant or the neat little specializing factory, TRUMBULL FLEX-A-POWER distributes industrial power to any or all points of load with maximum safety . . . minimum expense.

This "plug-in" electrical highway is a standardized system of enclosed bus bar units which may be connected to form a simple, straight road or a vast network of avenues and streets from which power, by means of Flex-A-Plugs, is carried directly to your machines.

Initial investment is LOW . . . installation, FAST . . . any future change or expansion, a SIMPLE procedure . . . maintenance, practically NIL . . . and the entire system is almost 100% SALVABLE.

FLEX-A-POWER can be one of your most potent weapons both for war plant expansion and peacetime reconversion.



Installation of low cost "125" Flex-A-Power in a small workshop. "125" is recommended for total connected loads up to 250 amperes.

Installation of "FVK" Flex-A-Power in a large industrial plant . . . "FVK" is available in 3 capacities: 250, 400 and 600 amperes. Main or "Header" Bus Installation of "LVD" Buss-Wa may be used to feed individual runs of "FVK" Flex-A-Power.

THE TRUMBULL ELECTRIC MANUFACTURING CO.

A GENERAL ELECTRIC ORGANIZATION

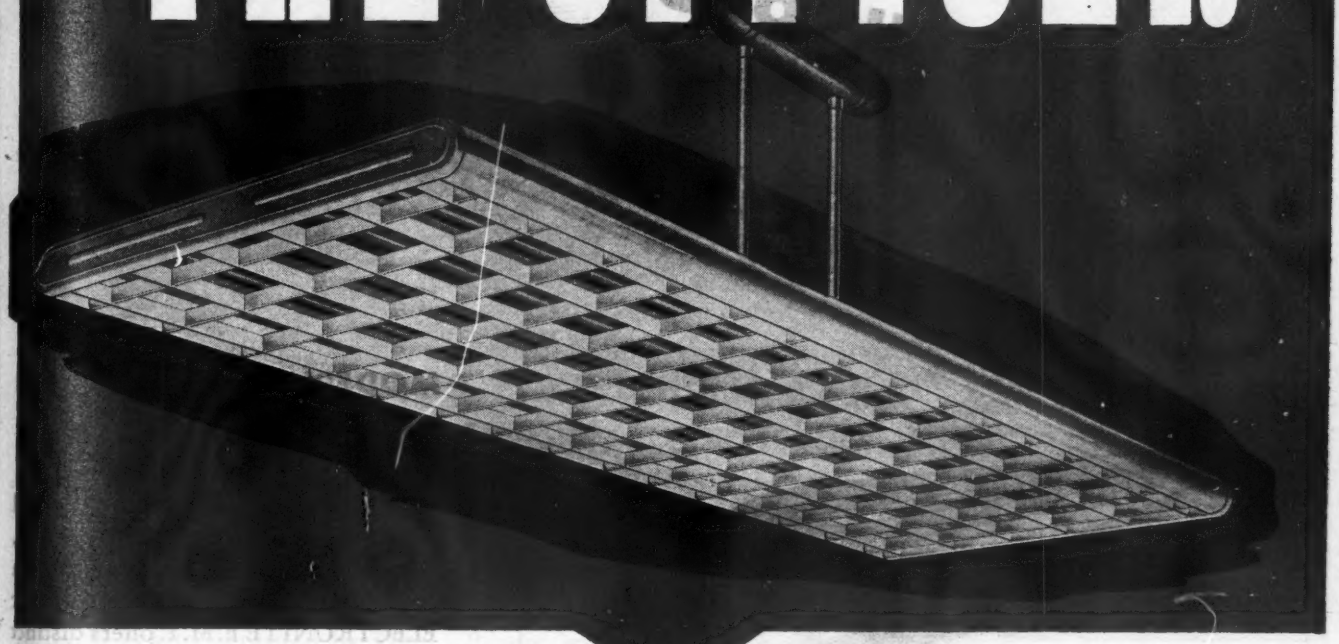
OTHER FACTORIES AT NORWOOD (CINN.) O.
SEATTLE — SAN FRANCISCO — LOS ANGELES

PLAINVILLE, CONNECTICUT

Leader

PRESENTS

"THE OFFICER"



LEADER "Know How" BRINGS THE ADVANTAGES OF FUTURE LIGHTING Today

Unusual beauty incorporated through skillful engineering with the ultimate in servicing and construction features, makes the new Officer ... Model VL-440, a fascinating addition to the Leader line of fluorescent fixtures.

Diffusion of natural lamp brightness is accomplished by use of a steel high gloss louvre without sacrificing light output. The translucent side panels of durable molded plastic allow light transmission without glare, producing a soft illuminating effect. Side panels of steel also available as optional equipment. Louvers are furnished with either a 45° or a 31° cut-off.

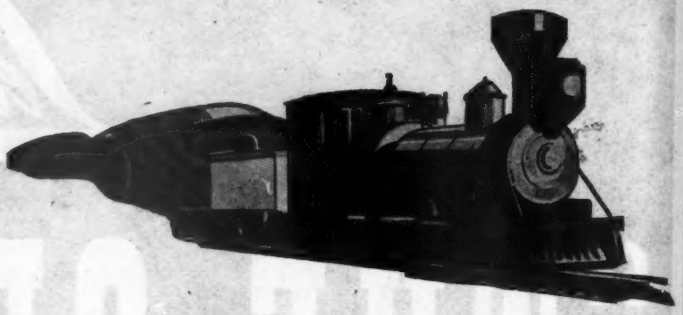
Wafer thin, clean cut appearance insures trim and smart installations, improving the lighting facilities and enhancing the beauty of the establishment.

Leader VL-440 is designed for individual or continuous run mounting for either ceiling or pendant installation. The louvre, flush in unit is hinged on one side to permit servicing of unit. Tracks for surface mounting of fixture can be provided to facilitate installation. Brackets are fastened to unit and after fixture slides on the tracks, the automatic lock prevents fixture from sliding off track. No screws are necessary.

VL-240—A two 40 watt lamp, companion unit to the "Officer" similar in design and appearance to the "Officer"; for installation requiring less light concentration.

TYPICAL VL-440 INSTALLATIONS

LEADER ELECTRIC MANUFACTURING CORP., 6127 N. Broadway, Chicago 40, Ill. -- 2040 Livingston St., Oakland 6, Calif

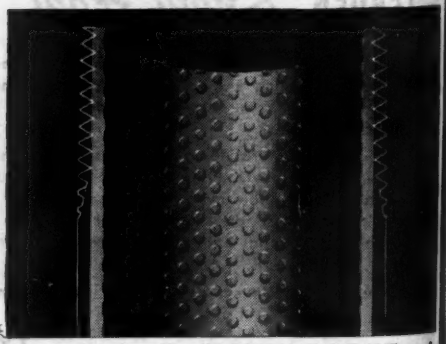


LIKE THE RAILROAD TRAIN

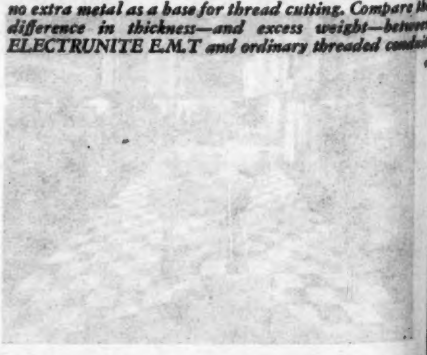
Electrical Raceways

MODERN, STREAMLINED

WHETHER you choose electrical conduit on the basis of safety, ease of installation, or cost—or a combination of all three—Republic ELECTRUNITE E.M.T. offers distinct advantages in practically every type of construction. Consider the following—then decide for yourself.



Because it is threadless, ELECTRUNITE E.M.T. needs no extra metal as a base for thread cutting. Compare the difference in thickness—and excess weight—between ELECTRUNITE E.M.T and ordinary threaded conduit.



I have gone modern, too!

RACEWAYS OF REPUBLIC ELECTRUNITE E. M. T. WILL HELP YOU KEEP ON PROFITABLE SCHEDULE

SAFETY—ELECTRUNITE E.M.T. provides adequate electrical and mechanical protection as determined by Underwriter's Laboratories. It is also approved by The National Electrical Code for exposed, concealed or concrete slab construction.

Its uniform, tightly-adherent zinc coating gives continuous rust and corrosion protection—unbroken by threads and unmarred by pipe wrench teeth.

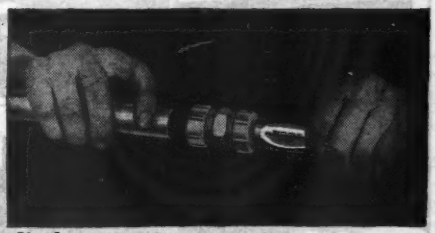
EASE OF INSTALLATION—Because it is threadless . . . Inch-Marked . . . light in weight . . . and easy to bend, Republic ELECTRUNITE E.M.T. goes in quicker—saves time and headaches in difficult, hard-to-reach installations.

Two simple compression-type fittings create strong, water-tight joints that will not vibrate loose.

With the patented ELECTRUNITE Bender, standard radius bends can be predetermined and made rapidly and accurately, either in the shop or on the job.

COST—The material cost of an ELECTRUNITE E.M.T. installation—including all necessary fittings—compares favorably with old-style threaded conduit installations.

For more information on this *modern,* lightweight, rigid steel conduit, see your local Republic ELECTRUNITE Distributor.



Simple, compression-type coupling creates strong, water-tight joints in a hurry . . . is easily tightened with a pair of pliers.

Predetermined bends are made easily and quickly with the patented ELECTRUNITE Bender and "Inch-Marked" Electrunite E.M.T.

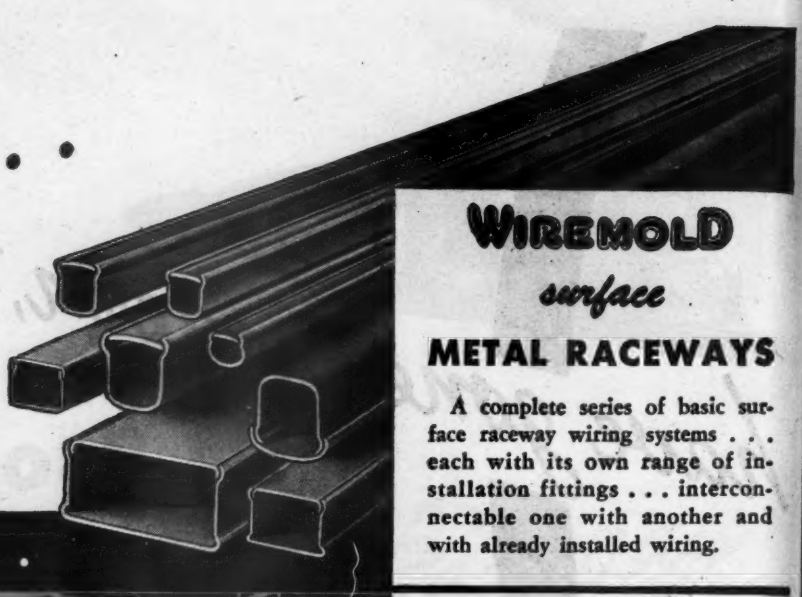
REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Bldg., New York 17, N. Y.

Republic
ELECTRUNITE E.M.T.
REG. U. S. PAT. OFF.

LIGHT WEIGHT THIN-WALL RIGID STEEL CONDUIT

What to use . . .

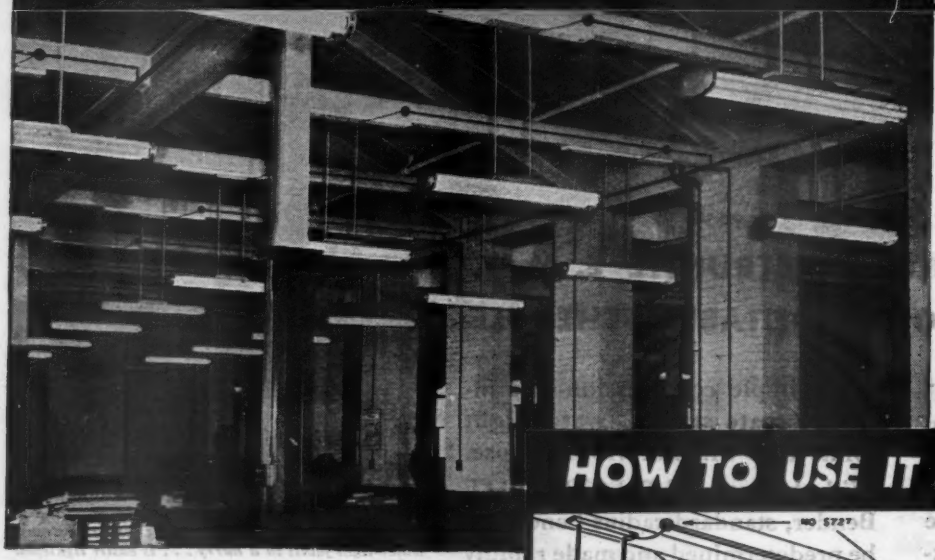
for convenience, economy, efficiency . . in the installation of modern lighting systems, whether incandescent, fluorescent or newly developed light sources are specified.



WIREMOLD *surface* METAL RACEWAYS

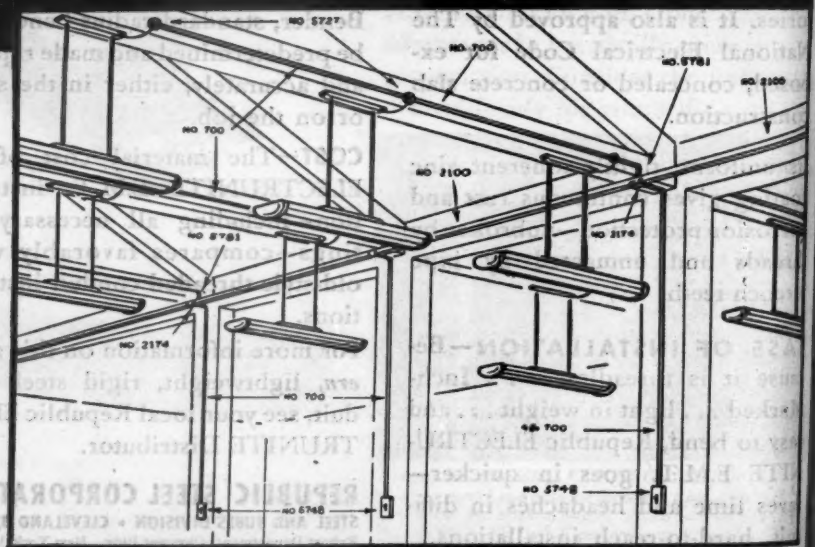
A complete series of basic surface raceway wiring systems . . . each with its own range of installation fittings . . . interconnectable one with another and with already installed wiring.

WHERE TO USE IT . . .



In this photograph is shown a typical use of Wiremold 2100 and 700 raceways with their installation fittings in wiring a building of mill type construction for fluorescent lighting units. Note the wide adaptability of Wiremold in handling a difficult ceiling installation and the convenient arrangement of switch controls on the building columns.

HOW TO USE IT . . .



Diagrammatic drawing shows the fittings used in this type of installation and emphasizes the interconnectability between the different sizes of raceway, which is an important feature of Wiremold. By using the various sizes of Wiremold raceways, interconnecting with each other and with existing wiring installed in the building, it is possible to plan a complete wiring layout from panelboxes to outlets with maximum economy in material and in time of installation. Write to The Wiremold Company, Hartford 10, Conn., for a copy of the Wiremold Catalog and Wiring Guide #16A and Engineering Data Sheets covering this type of installation.

THE WIREMOLD COMPANY
Hartford 10, Connecticut

ELECTRICAL CONTRACTORS

Business publications like these, with aggregate circulation of over 240,000 monthly among your prospects and customers, carry Wiremold advertising messages designed to HELP YOU BUILD BUSINESS. Tie in with this aggressive promotion program.

NEMA

KNOW YOUR WIREMOLD . . .

ARMY E NAVY

BUSINESS BUILDER IN TOMORROW'S MARKET FOR ADEQUATE WIRING

No. 1 HELPFUL HINTS ON APPLYING CAPACITORS

To help you improve power factor, reduce kva demand, increase circuit loadability and, often, reduce power costs

A WORKABLE DEFINITION OF THE TERM "POWER FACTOR"

The term arose because, in alternating-current circuits, the energy supplied to induction motors, transformers, and other inductive equipment is composed of *two* kinds of current:

1. Power-producing (or "working") current, which is converted by the equipment into useful work.

2. Reactive current (also called "magnetizing," "nonworking," or "wattless"), which is needed to magnetize inductive equipment before it will operate and while it is operating.

This current is *not* converted by the equipment into useful work. For example, it provides the flux across the air gap of an induction motor, through which the kilowatts flow to do work connected to the shaft. The *vector sum* (explained at the right) of these two currents is termed the "total current"—the actual current supplied to the load.

"Power factor" simply expresses the ratio of power, or "working," current to the total current.

The "working" current is usually expressed in watts or kilowatts, the total current in volt-amperes (volts × amperes) or kilovolt-amperes $\frac{(\text{volts} \times \text{amperes})}{1000}$, or in a 3-phase system $\frac{(\sqrt{3} \times \text{volts} \times \text{amp})}{1000}$.

Hence, in a formula: Power factor $= \frac{\text{kw}}{\text{kva}}$

Example:

What is the power factor of the load on a 460-volt, 3-phase system if an ammeter shows 100 amperes in the circuit and a wattmeter reads: 63.6 kilowatts?

Since, in a 3-phase circuit:

$$\text{Kva} = \frac{\sqrt{3} \times \text{volts} \times \text{amperes}}{1000}$$

$$= \frac{1.73 \times 460 \times 100}{1000} = 79.6$$

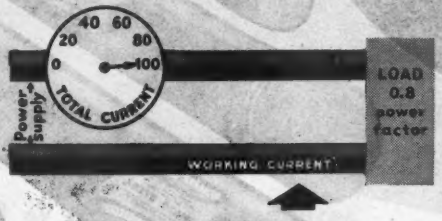
$$\text{Power factor} = \frac{\text{kw}}{\text{kva}} = \frac{63.6}{79.6} = 0.8 \text{ or, as often expressed, } 80\%.$$

WHAT "POWER-FACTOR IMPROVEMENT" REALLY IS

To "improve power factor" you simply neutralize or eliminate the reactive current from the feeder by supplying it locally. When this current is completely neutralized, all the current is "working." When the "working" current and total current are equal, the power factor is "unity," or, as sometimes expressed, 100%.

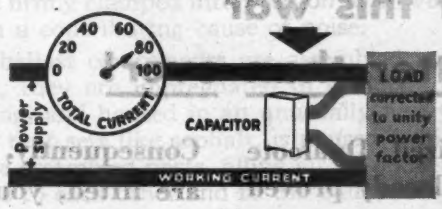
Capacitors are usually the easiest, quickest, and least expensive method of supplying reactive current. They are "generators" of the reactive current required by inductive loads. When they are located near the load, they furnish the magnetizing requirement direct, and the power circuit need furnish only the "working" current.

Using the case at left as an example:



The load draws 100 amperes from the supply circuit. Because part of the current is consumed by the magnetizing requirements (orange line) of the load, only 80 amperes are actually being converted into useful work.

After a capacitor is added, the magnetizing requirement is supplied by the capacitor, and it is necessary for the supply circuit to deliver only 80 amperes to get exactly the same work. *No feeder capacity is wasted in nonproductive work.*



Similarly, if four such loads were fed from the same circuit, the supply current would be sufficiently reduced, by means of the capacitor, to make it possible to add another load of the same magnitude without increasing the current.

WHERE 100 − 80 = 60

In the first sketch shown above, it would appear that since the current supplied to the load is 100 amperes, and since only 80 amperes of this are being converted to useful work, the magnetizing requirement of the load must be the difference between the two, or 20 amperes. Hence, it might further be assumed that a 20-ampere capacitor should be installed to compensate for the magnetizing requirement. However, neither of these assumptions is correct. The subtraction of the "working" current from the total current never equals the magnetizing requirement—an important fact to remember. The relationship of the "working" current to the total current is known as a "vectorial" relationship. Although difficult to explain in a few words why this is so, the relationship itself is easy to show with a right triangle.

This right triangle makes it easy to find the correct value of the magnetizing

current (X), by using the well-known formula for a right triangle, viz., the square of the longest side is equal to the sum of the squares of the other two sides. Therefore,

$$(80)^2 + (X)^2 = 100^2$$
$$(X)^2 = 10{,}000 - 6400 = 3600$$
$$X = 60$$

Therefore, a capacitor that will deliver 60 amperes must be installed to supply the full magnetizing requirement of the load, rather than a 20-ampere unit, as might at first be supposed.

Capacitor *application* data can be obtained by writing for Bulletin GEA-3225A. Bulletin GEA-2742C will bring you *product* data on Pyranol capacitors for power-factor improvement. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

* Continuously-milled rigid steel pipe, twice protected against corrosion by a sherardized zinc coating and a final acid and alkali-proof covering.

will come out of this war tougher and better than ever!

Before the war, Walkerized Dualcote Rigid Steel Conduit had already proved its durability under the worst corrosive conditions. In laboratory tests and in actual use, its superior finish had defied acids, alkalies and salt water where ordinary conduits had failed to stand up.

War has restricted the manufacture of Dualcote for general use. But in its wartime uses, Dualcote has had to withstand the most severe conditions on land and at sea.

Consequently, when wartime restrictions are lifted, you'll find Dualcote conduit even "tougher" and more durable than ever. Its *fighting finish* will be ready to *take it* in chemical plants, dye houses, mines, mills, refineries — or in any other installation that requires a conduit that can defy corrosion!

Ask your local distributor about prices and deliveries. For further information, write to Walker Bros., Conshohocken, Pa.

WHY you need this SILENT PARTNER in your fixture business

THE QUIET OPERATION of G-E ballasts reduces noise complaints and promotes customer good will

G-E BALLASTS are so designed and built that hum (present to some degree in all a-c devices) has been reduced practically to the point of inaudibility.

For example, the ballast coils are *machine* wound to eliminate "springy layers," and to provide units of unvarying rectangularity. The cores are stacked automatically from high-quality, low-loss steel laminations that are cut to exact dimensions. Thus, precisely the right amount of core steel can be fitted snugly around each coil, and firmly clamped into position to prevent "play" or shifting of parts—so often a contributing cause of noise.

In addition, after all the various ballast components are assembled in a mechanically strong clamping frame, they are impregnated in a moisture-resistant varnish, and cured by baking, and housed in an unusually heavy-gage steel case. A special compound, that sets like asphalt, is poured (while hot and fluid) over and around all the assembled parts, filling all air pockets and voids and sealing the components to each other and to the ballast case. The result is a solid, cohesive ballast without noise troubles.

As a final precaution, one of the many tests which every G-E ballast must pass is an exacting noise test.

It is attention to details of this sort, and quality control during manufacture, that are responsible for the fact that, of the 16,000,000 G-E ballasts installed since 1938, 99.5 per cent are still giving quiet, successful service.

Write for Bulletin GEA-3293F for data on our complete line of ballasts for fluorescent lighting. *General Electric Company, Schenectady 5, New York.*

These ballast features help keep fixture users satisfied—they mean added profits for you

1. Low noise level—for satisfied users
2. Long life—for low replacement cost
3. Characteristics matched with lamp—for rated lamp life and light output
4. Dimensions that permit use of one wiring channel for practically all fixtures—for simplified parts inventory and lower fixture cost

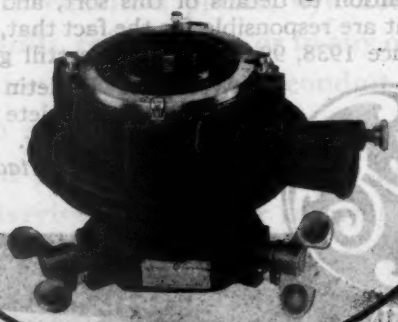
BALLASTS
LAMPS
STARTERS
LAMPHOLDERS
CABLE—stand for DEPENDABILITY in fluorescent lighting

Buy all the BONDS you can —and keep all you buy

For the big job in *New Building*

When you unfold the blueprints for new homes... new commercial buildings... new plants and reconversion... start the job *right* with TOLEDO Pipe Tools! These are the tools for best work by green hands or experienced mechanics—unbeatable for accurate, reliable, easy-threading operation for nearly half a century.

Toledo Engineering Leadership designed this ahead-of-the-times tool... the Toledo SIMPACT Threader! Entirely self-contained, adjustable for 1″ to 2″ pipe. Sizes changed instantly with one set high speed steel dies. Accurate, dependable. Specify TOLEDO for better pipe tools and better building! The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Bldg.



RELY ON THE LEADER... TOLEDO

FOR PRECISION PIPE TOOLS

Every coating of adhesive compound in SI tape is calendered and thoroughly bonded to every other coat, and to the fabric.

Kleen Kut is a "dry" tape, not sticky or messy, with permanent adhesive qualities.

Not a "war baby"... but a brand new Mintert calender-process tape, laboratory developed to provide greater adhesive and tacky properties.... Try Super-stik and see how it sticks to the job because it sticks to itself—is clean, not messy—doesn't stick to the hands—high tensile—doesn't ravel, peel, curl or unwind.

As the newest member of the well-known SI family, Super-stik is available on suitable priorities. Ask for a sample.

SUPERIOR INSULATING TAPE CO.
ST. LOUIS, MO., U. S. A.
Established 1923

Each 75-ft. roll individually wrapped and sealed in cellophane. Packed 10 rolls to the can.

Super-stik

FRICTION TAPE

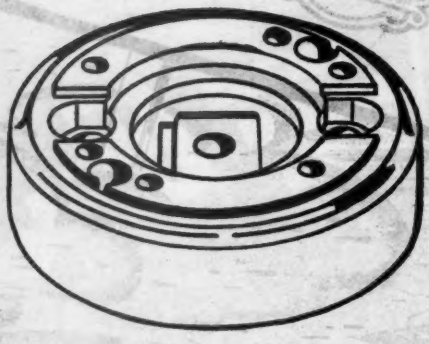
"Sticks to the End"

S-750

Obtainable only from factory authorized electrical wholesalers

FOR CEILING CIRCUITS... USE THIS BRYANT PULL SWITCH LINE

Heavy gauge metal bridge and chain channel keep mechanism in line and prevent fouling of pull chain.

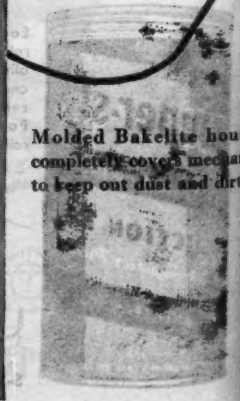


A tough, white, glazed porcelain base holds the switch mechanism securely and provides a strong anchor for mounting.

You will find these switches dependable and particularly useful for commercial and industrial installations where control of ceiling or branch circuits is desired for single or multiple fixtures. Single-pole, double-pole, three-way, four-way and two or three-circuit models are available in either solid or slotted base types for 10 amp, 125 volt—5 amp, 250 volt service. Either wall or cover-mounted type can also be supplied. See full listing on page 72 of the Bryant No. 40 catalog.

Switch mechanism is ruggedly built with the action powered by a heavy full-tension steel spring.

Contacts are heavy gauge with adequate terminal screws to provide wiring facility.



Molded Bakelite housing completely covers mechanism to keep out dust and dirt.

Specify Bryant Devices from your Electrical Wholesaler

THE BRYANT ELECTRIC COMPANY

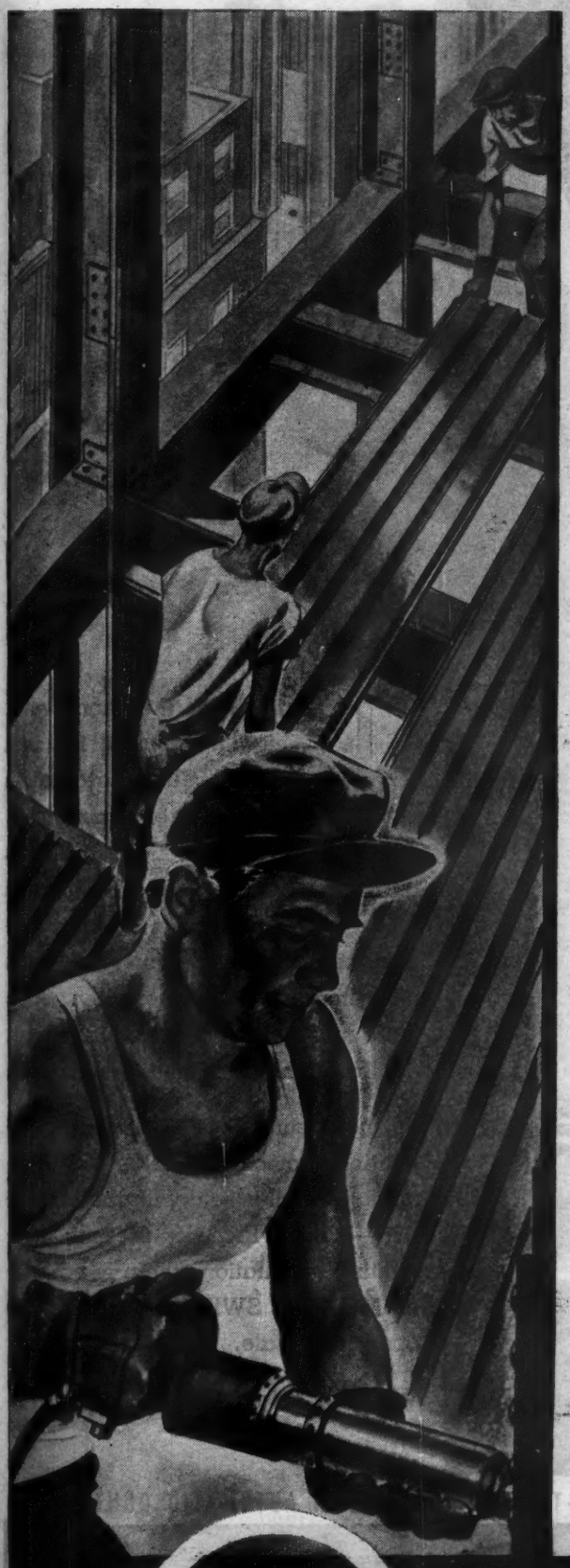
SUPERIOR WIRING DEVICES

BRIDGEPORT 2, CONNECTICUT

ARMY (E) NAVY

NEW YORK SAN FRANCISCO CHICAGO LOS ANGELES

A SUBSIDIARY OF WESTINGHOUSE ELECTRIC CORPORATION



With a built-in demand for

more and more electricity

Q-Floors are going in.

That's an invitation to all tenants—as long as the building stands—to keep on changing their minds about where they want electrical outlets. And every time they change an outlet, they call an electrician to take up the old and install the new.

Q-Floors are sold on their unlimited electrical availability. An outlet is possible on every six-inch area of the floor. This encourages the use of more electrical equipment, stimulates frequent electrical change in order to keep floor plans up to date.

Q-Floors promote *more and more electricity.*

H. H. ROBERTSON COMPANY

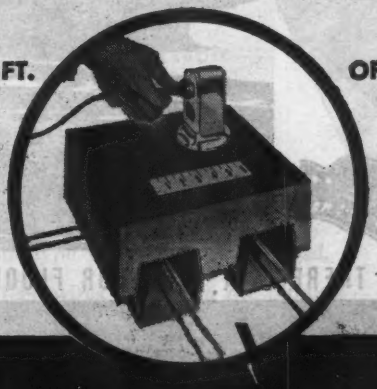
2400 Farmers Bank Building, Pittsburgh, Pennsylvania

Offices in 45 Principal Cities World-Wide Building Service

★ ★ ★

Electrical Fittings for use with Robertson Q-Floors can be obtained from General Electric Construction Materials distributors. See the nearest G.E. merchandise distributor for information on how Q-Floor fittings can be used to attain up-to-the-minute electrical wiring.

THIS IS 1 SQ. FT. OF Q-FLOOR



Q-FLOORS

SANGAMO
TIME SWITCHES
for Floodlighting Protection

NIGHT Like Day is BRIGHT

There are types to meet every protective lighting control need. The complete line includes Astronomic Dial, Synchronous Carry-Over, and Outdoor Time Switches. Form VSWZ Astronomic Dial Synrhronous Carry-Over Time Switch is shown above. Current interruptions up to 10 hours will not stop it nor affect its "on" and "off" settings.

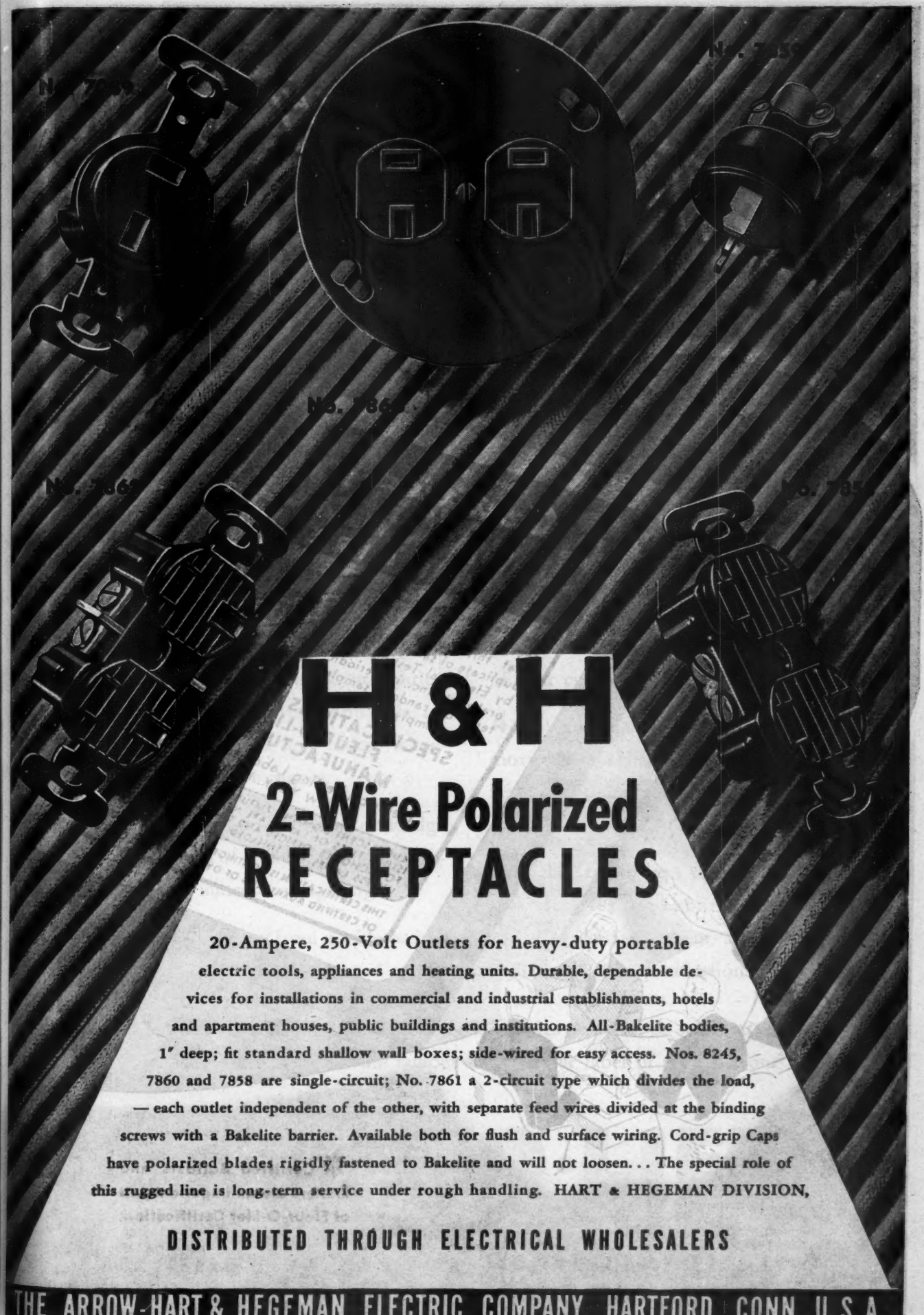
WHEN the shadows of night begin to fall it is then that floodlighting assumes importance in the matter of protection. At this exact period, floodlighting is turned on, and to have the greatest value in full protection, starting time must be accurate. So must the "lights off" time be clocked exactly. Also, there must be no mistakes in turning off floodlighting at in-between times.

To make sure of this full time floodlighting protection, SANGAMO Automatic Control is sold with the installation — and where in present floodlighting installations there is no SANGAMO TIME SWITCH, opportunity is open for a sale.

Write for catalog.

WHERE THERE IS A NEED FOR FLOODLIGHTING···THERE'S A SALE FOR AUTOMATIC CONTROL···

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS



H & H

2-Wire Polarized RECEPTACLES

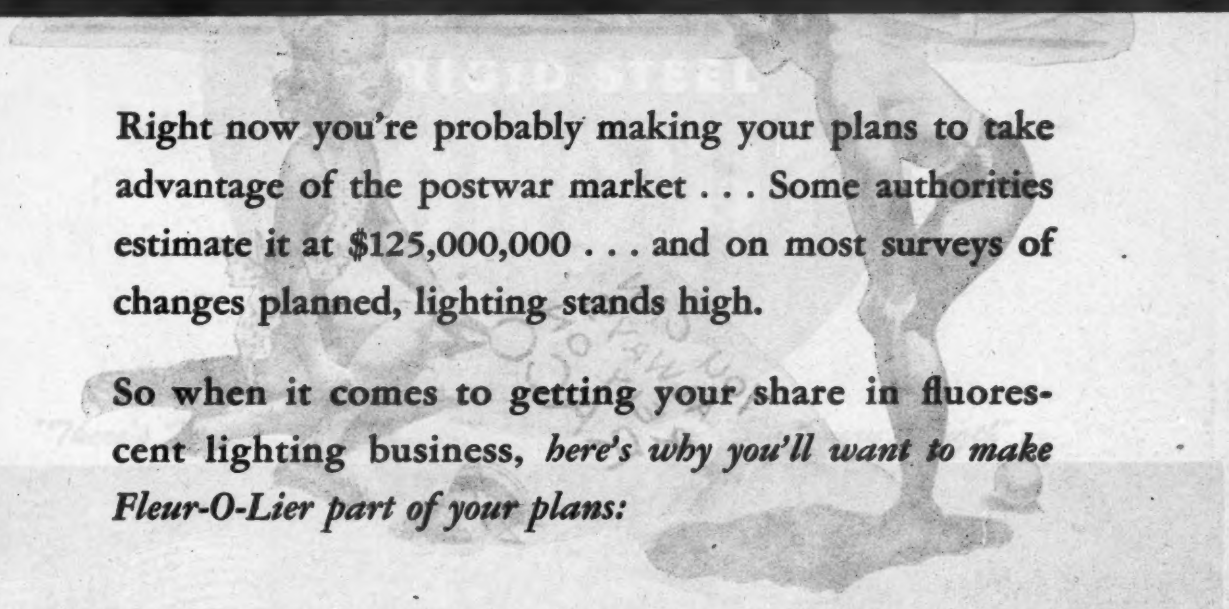
20-Ampere, 250-Volt Outlets for heavy-duty portable electric tools, appliances and heating units. Durable, dependable devices for installations in commercial and industrial establishments, hotels and apartment houses, public buildings and institutions. All-Bakelite bodies, 1″ deep; fit standard shallow wall boxes; side-wired for easy access. Nos. 8245, 7860 and 7858 are single-circuit; No. 7861 a 2-circuit type which divides the load, — each outlet independent of the other, with separate feed wires divided at the binding screws with a Bakelite barrier. Available both for flush and surface wiring. Cord-grip Caps have polarized blades rigidly fastened to Bakelite and will not loosen... The special role of this rugged line is long-term service under rough handling. HART & HEGEMAN DIVISION,

DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

MAKE this THE heart OF YOUR
THIS IS A
Certified
FLEUR-O-LIER
LUMINAIRE
The Manufacturer guarantees by affixing this Label that this Luminaire is a duplicate of samples found by Electrical Testing Laboratories, Inc. in periodic tests of random samples to comply with the
SPECIFICATIONS OF THE FLEUR-O-LIER MANUFACTURERS
Electrical Testing Laboratories, Inc.
NEW YORK, N. Y.
CERTIFIED
ETL
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 95% POWER FACTOR

Postwar Lighting Sales!



Right now you're probably making your plans to take advantage of the postwar market . . . Some authorities estimate it at $125,000,000 . . . and on most surveys of changes planned, lighting stands high.

So when it comes to getting your share in fluorescent lighting business, *here's why you'll want to make Fleur-O-Lier part of your plans:*

1. You have more than thirty of the leading makers of fluorescent lighting fixtures to supply you. And this includes the biggest and oldest manufacturers in the business.

2. You avail yourself of the knowledge and research of many of the finest technicians in fluorescent lighting.

3. You can choose from a wide variety of fluorescent fixtures designed to appeal to the taste and to the style needs of your customers.

4. You get fixtures built to definite, authoritative specifications that mean the best in lighting performance and service.

5. You get fluorescent lighting fixtures that are subject to rigid test by Electrical Testing Laboratories, Inc., and Certified by them as meeting FLEUR-O-LIER specifications.

So when you plan for fluorescent lighting sales postwar, be sure that the fixtures you carry wear the famous Fleur-O-Lier label of Certification.*

FLEUR·O·LIER

Manufacturers

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

"Betcha don't know who Raco is!"

Of course *they* don't know that Raco is a trade-marked line of All-Steel-Equip Company . . . a complete line of steel switch boxes, outlet boxes and fittings. The line that has won the approval of architects, builders and contractors throughout America.

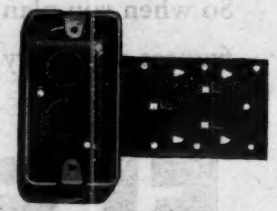
WHY YOU, TOO, CAN "RELY ON RACO"

You can rely on Raco to be the clean line. No dirt or grease . . . keeps its smooth, attractive appearance! And Raco products are packaged. You can rely on each product coming neatly packed in protective cartons . . . with readable index showing number, quantity and finish.

You can also look for uniform standards. The same exacting standards are used as in other precision products that All-Steel has been manufacturing for more than 32 years. Remember, the Raco-All-Steel line is *sold nationally through wholesalers only*. Look for the Raco trade-mark . . . it signifies the quality line, the line you can "rely on."

←400½-O—STANDARD (UTILITY) BOX. *With "Side-Mount" Bracket. Enameled or galvanized finish.*

400½-B—STANDARD (UTILITY) BOX. *With "Face-Mount" Bracket. Enameled or galvanized finish.*→



ALL-STEEL-EQUIP COMPANY, INC.
600 Kensington Avenue, Aurora, Illinois

RACO · ALL-STEEL · PRODUCTS
SWITCH BOXES · OUTLET BOXES · CONDUIT FITTINGS

CENTRAL

RIGID STEEL

CONDUIT

"There's Tested Strength in Every Length"

The excellence of its past performance assures its future demand.

for

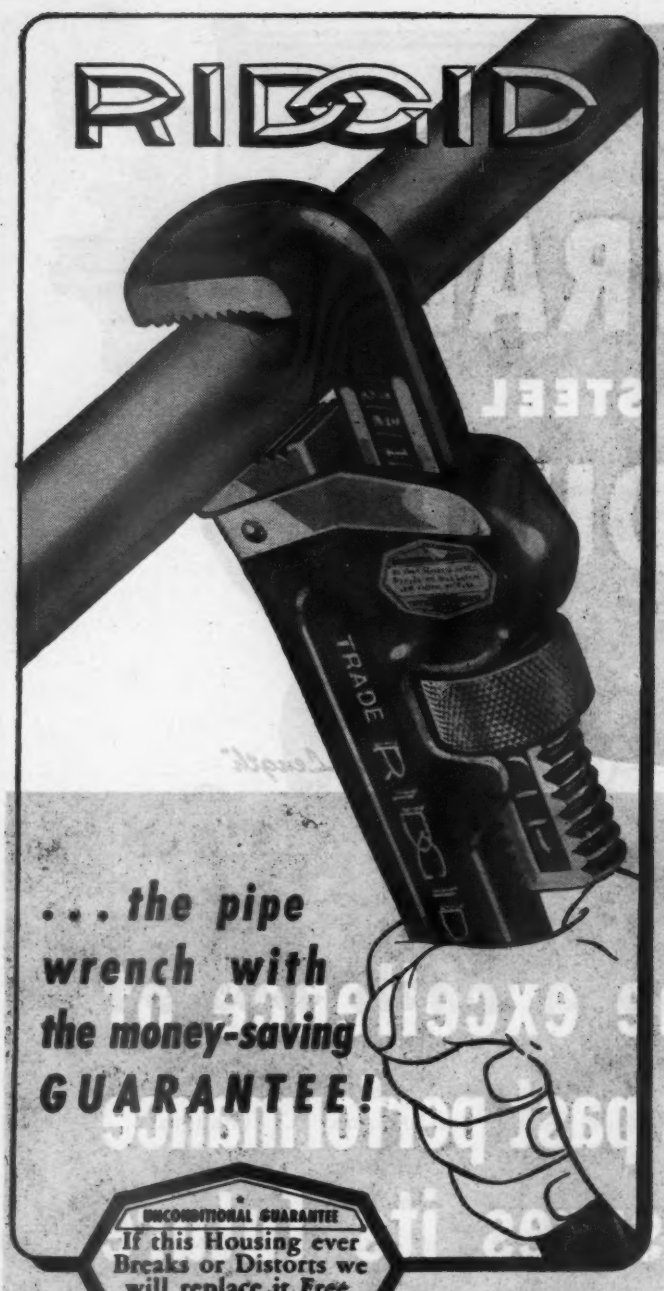
SPANG-CHALFANT

Division of The National Supply Company

General Sales Office: Grant Building, Pittsburgh 30, Pa.

District Offices and Sales Representatives in Principal Cities

RIDGID



. . . the pipe wrench with the money-saving GUARANTEE!

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free
COPR. 1952
THE RIDGE TOOL CO.
ELYRIA, O.

● That straight-forward guarantee means that the RIDGID saves you all bother and expense of wrench housing repairs — an important saving. But this unusual wrench gives you also full-floating hookjaw, and replaceable heeljaw that take hold instantly, won't lock on pipe, won't slip. Adjusting nut in open housing always spins easily. Safe powerful I-beam handle has comfort-grip you'll like. For economy and easier work, ask your Supply House for the RIDGID.

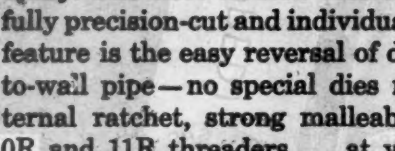
Quick Clean Threads

with these tough little steel-and-malleable

RIDGID
RATCHET THREADERS

No special dies needed for close-to-wall threads

● Snap in the size die head you want — from either side, it can't fall out — and you're ready to cut smooth clean threads from ⅛" to 1¼" — quickly, easily. The heat-treated toolsteel dies are beautifully precision-cut and individually tested. A handy feature is the easy reversal of dies to thread close-to-wall pipe — no special dies needed. Smooth internal ratchet, strong malleable drive ring. Buy 0R and 11R threaders . . . at your Supply House.



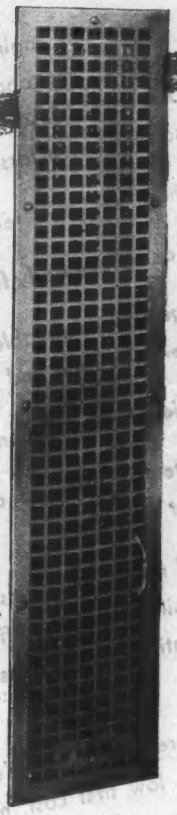
Handy carrier with any combination of sizes.

Millions of RIDGID Tools in use

RIDGID
WORK-SAVER PIPE TOOLS

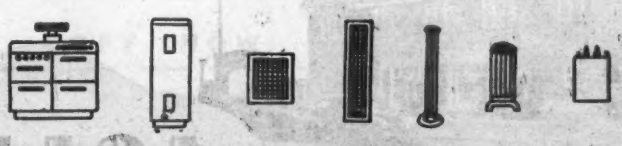
The Ridge Tool Company
Elyria, Ohio, U. S. A.

A "MUST" IN YOUR POST-WAR HOME



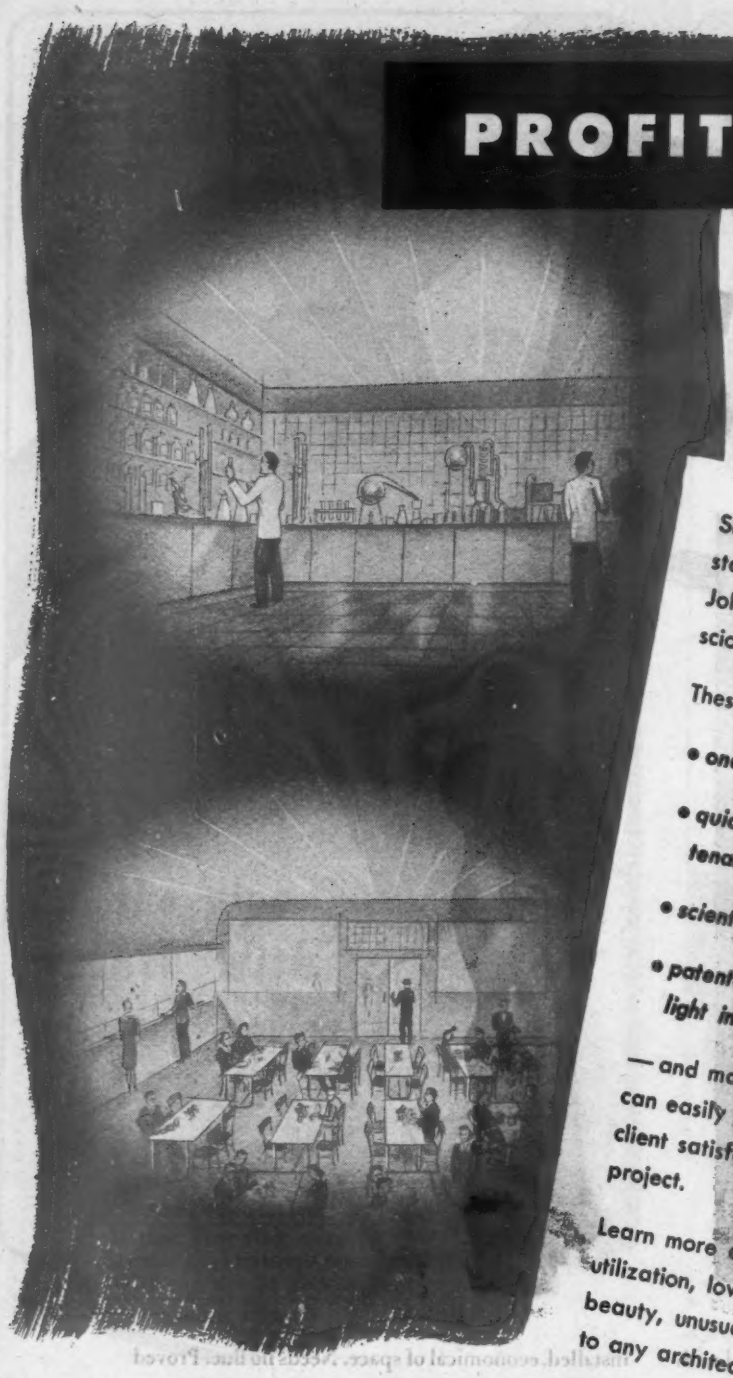
Thermador's famous "Head-To-Heels" Electric Bathroom Heater

At the flip of a switch the bathroom is flooded with fumeless, flameless warmth—clean and fresh. Thermador "Head-to-Heels" Heaters provide instant heat in the bathroom where it is almost always needed *without turning on the central heating system!* A "must" in the modern post-war home, in remodeling and, of course, in All-Electric Homes. ★ Easily installed, economical of space. Needs no flue. Proved in use from coast-to-coast. ★ "Head-to-Heels" Electric Bathroom Heaters are built by Thermador, pioneer manufacturer of electrical appliances—which means that they are soundly designed and solidly built for long and fool-proof service. ★ Write today for details and specifications for your post-war planning.



THERMADOR *Electrical Manufacturing Company*

5119 SOUTH RIVERSIDE DRIVE • LOS ANGELES 22, CALIFORNIA



PROFIT INSURANCE!

JOLECO FLUORESCENTS OFFER LOW COST INSTALLATION AND SERVICE

Significant engineering developments that provide substantial time and maintenance savings have gained for Joleco Fluorescents unusual preference among cost-conscious contractors, builders and engineers everywhere.

These exclusive features —

- **one-piece body for fast and simple one-man installation**
- **quickly removable reflector plates that reduce maintenance time and trouble**
- **scientific ventilation system to prolong ballast life**
- **patented principle of lamp positioning for increased light intensity**

— and many other outstanding innovations, ready soon, can easily mean the difference between profit and loss, client satisfaction or dissatisfaction, on every important project.

Learn more about Joleco's definite advantages in light utilization, low first cost, minimum maintenance, striking beauty, unusual flexibility of design, and adaptability to any architectural motif or lighting installation.

Write freely and fully, without obligation, about your *specific* lighting problems.

Joleco Fluorescents are used throughout the ultra-modern Socony-Vacuum, Lubrite Division, Administration Building in St. Louis.

JOLECO
CORPORATION
Designers and Manufacturers
FLUORESCENT LIGHTING FIXTURES

WHAT PEOPLE REALLY WANT IS *Electrical Living*

Ready

TO HELP YOU MAKE HOME WIRING PROFITABLE

Wiring in homes for modern Electrical Living requires the experience and technical knowledge of responsible electrical contractors.

In this new Handbook you will find valuable ideas that offer real opportunities for your business in the home wiring field. It will bring you up to date on the latest electrical home equipment, and on the technical developments in home wiring so necessary to serve this field properly.

It has ten chapters. 120 pages. Dozens of charts, tables and diagrams. Suggested specifications for architects. Costs one dollar. Get a copy today and put it to work . . . building a plus volume for you at a profit, and with greater customer satisfaction.

I-91518-B

ORDER YOUR COPY NOW!

Westinghouse Electric Corporation
Industrial Relations Department
306 Fourth Avenue, Pittsburgh 30, Pennsylvania
I enclose one dollar for a copy of the Home Wiring Hand book.

Name_____

Street_____

City_____ State_____

Westinghouse

BETTER HOMES DEPARTMENT

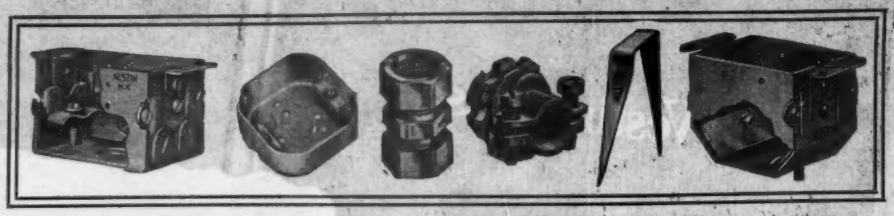
- Wires and Cables
- Entrance Fittings
- Outlet and Switch Boxes
- Conduit and Cable Fittings
- Service Connectors
- Yard Lights and Switches
- Hay Mound Lights

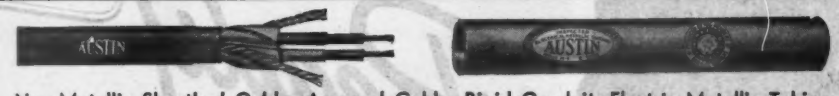
AUSTIN

- Poultry House Lighting Controls
- Electric Fence Controls
- Solder and Solderless Lugs
- Rubber and Friction Tape
- Bending Tools
- Fish Tape
- Reel Rollers

THE AUSTIN LINE HOLDS THE SOLUTION TO ALL FARM AND RURAL WIRING PROBLEMS . . . FROM THE HIGH LINE TO THE LAST OUTLET. MATERIAL FOR COMPLETE REA INSTALLATIONS THAT HAVE BEEN DESIGNED AND MADE FOR THIS PARTICULAR TYPE OF WIRING CAN BE SUPPLIED FROM THE AUSTIN LINE. EQUIP YOURSELF NOW TO GET YOUR SHARE OF THIS PROFITABLE BUSINESS.

WIRING BOXES and FITTINGS

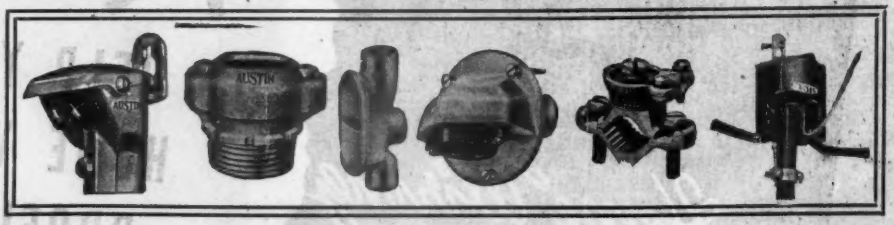


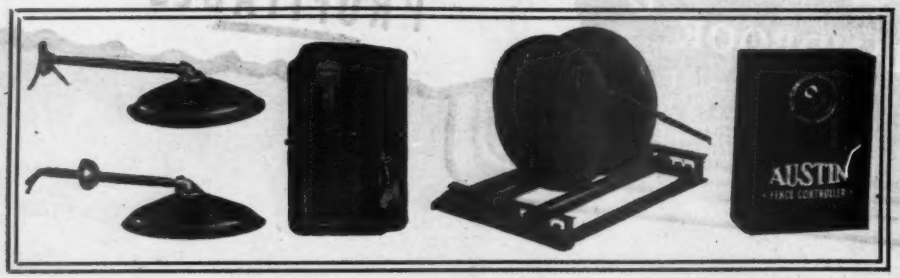


Non-Metallic Sheathed Cable, Armored Cable, Rigid Conduit, Electric Metallic Tubing (Thin Wall Conduit), Flexible Steel Conduit, Non-Metallic Flexible Tubing (Loom).

WIRING SYSTEMS

ENTRANCE FITTINGS and GROUNDING DEVICES





YARD LIGHTS

POULTRY HOUSE TIMING CONTROLS

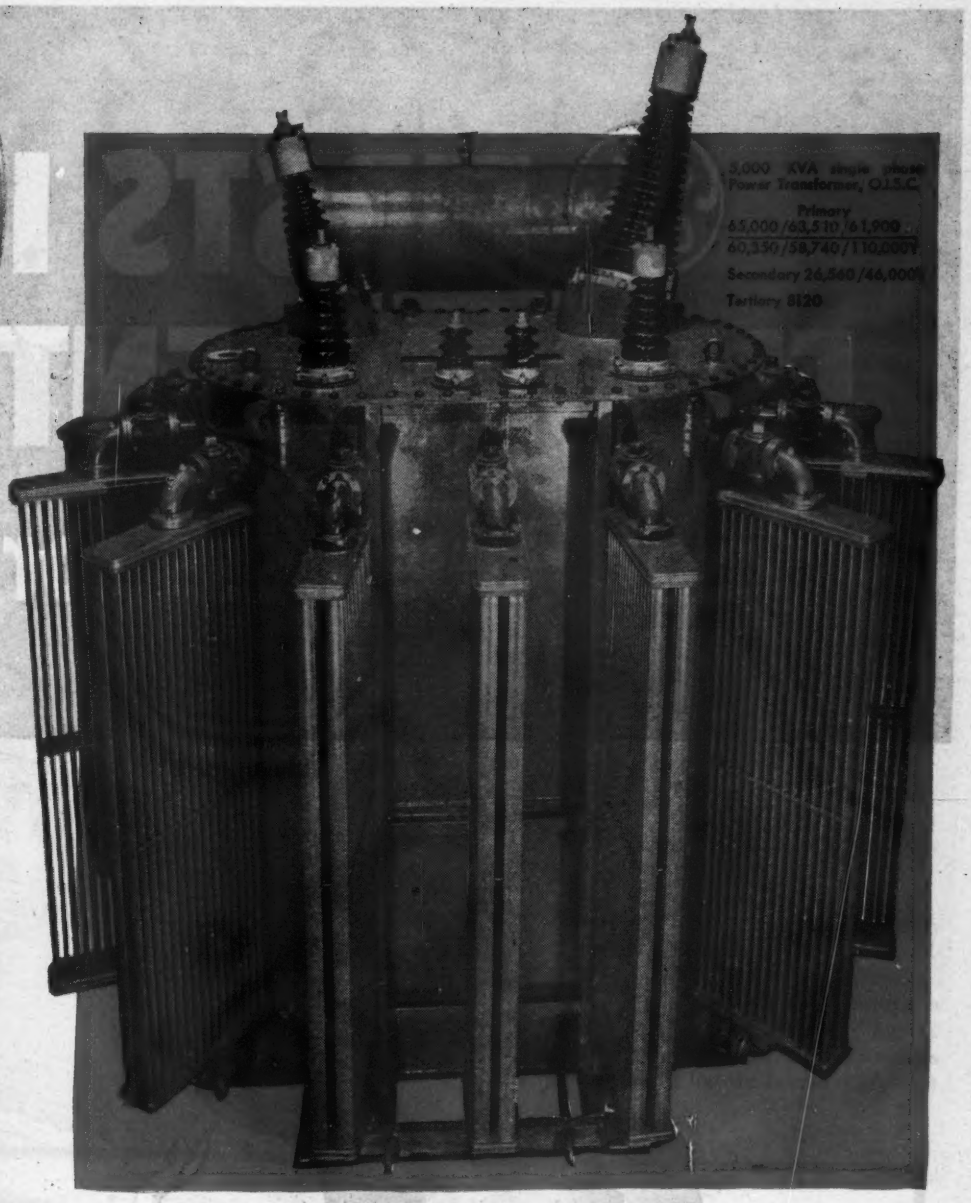
REEL ROLLERS

FENCE CONTROLLERS

THE M. B. AUSTIN COMPANY

108-116 So. DESPLAINES ST. CHICAGO 6, ILL.

AMER TRAN



UNDIVIDED ATTENTION

To Your Transformer Problem

When you submit a transformer problem to AmerTran, you draw upon the resources of the entire organization—not just a segment. For AmerTran concentrates on transformers, day in and day out, as it has for forty years.

Thus, when an AmerTran engineer studies your data, his recommendation is unhampered by consideration for other related products. The user benefits by optimum transformer performance.

THE AMERICAN TRANSFORMER CO.

AMERTRAN

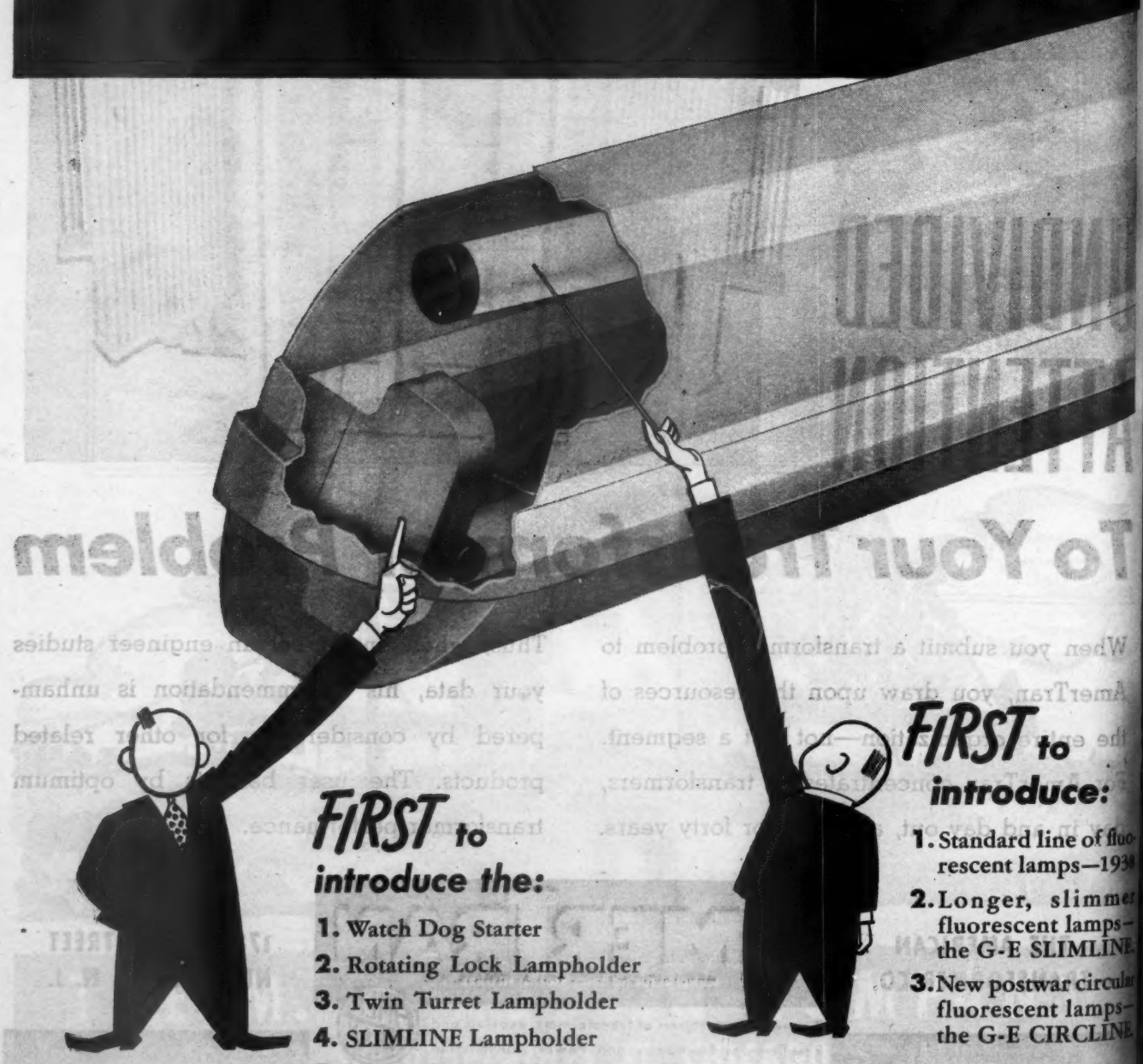
MANUFACTURING SINCE 1901 AT NEWARK, N. J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMER TRAN

178 EMMET STREET
NEWARK 5 N. J.

FIRSTS IN FLUORESCENT mean more business for you

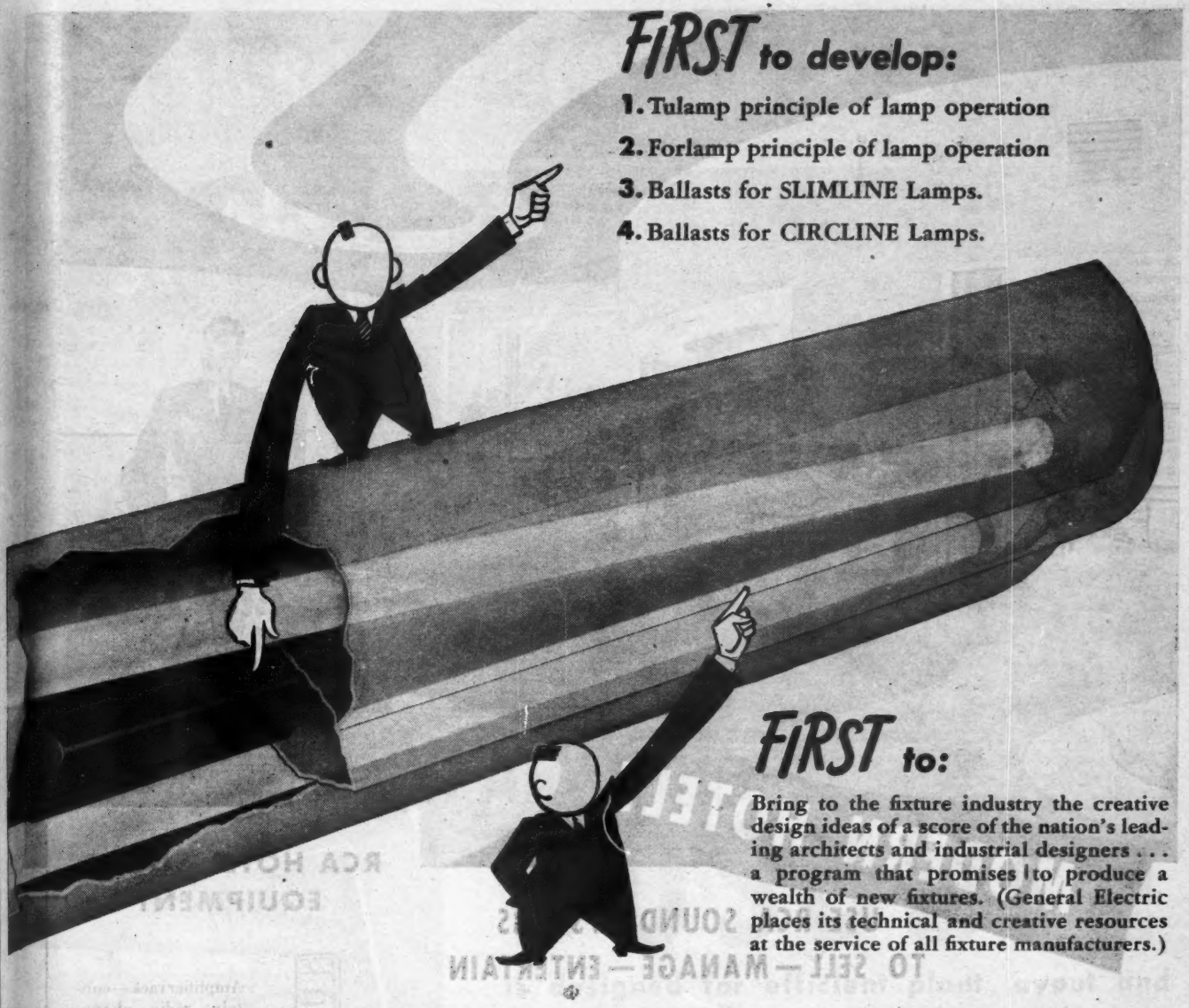


FIRST to introduce the:

1. Watch Dog Starter
2. Rotating Lock Lampholder
3. Twin Turret Lampholder
4. SLIMLINE Lampholder
5. CIRCLINE Lampholder

FIRST to introduce:

1. Standard line of fluorescent lamps—1938
2. Longer, slimmer fluorescent lamps—the G-E SLIMLINE
3. New postwar circular fluorescent lamps—the G-E CIRCLINE



FIRST to develop:

1. Tulamp principle of lamp operation
2. Forlamp principle of lamp operation
3. Ballasts for SLIMLINE Lamps.
4. Ballasts for CIRCLINE Lamps.

FIRST to:

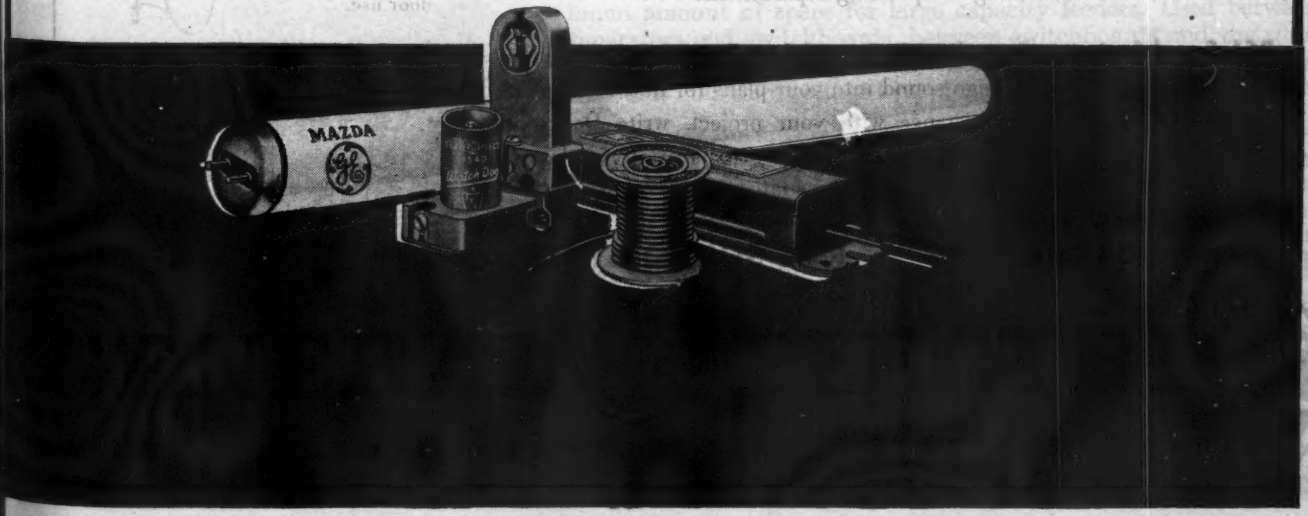
Bring to the fixture industry the creative design ideas of a score of the nation's leading architects and industrial designers . . . a program that promises to produce a wealth of new fixtures. (General Electric places its technical and creative resources at the service of all fixture manufacturers.)

You'll do a bigger and more profitable lighting business as a result of General Electric research. These achievements in fluorescent lighting will:

1—Give your customers simpler, more reliable performance.

2—Cost less, and make it possible for your customers to buy higher and higher levels of lighting.

3—Expand its field of application to cover many new uses.



MODERN HOTELS

USE RCA SOUND SYSTEMS TO SELL—MANAGE—ENTERTAIN

Centralized Radio entertains guests in their rooms, sells "extra" hotel services through spot announcements, provides means of issuing emergency instructions in case of fire or accident... *Paging Facilities* locate guests efficiently, without delay... *Selected Programs* of your own choosing may be sent to dining room, restaurant, lobby or other parts of the building... *Sound Reinforcing* in public rooms makes speeches or entertainment available to larger audiences... *Intercommunication Facilities* place manager and staff within instant touch, linking all operating departments.

RCA Sound Systems, Centralized Radio and Intercommunication Facilities —for every hotel need. Design sound into your plans for new or remodeled structures. If you need assistance with your project, write Department 70-137-BR, Sound Equipment Section, Radio Corporation of America, Camden, New Jersey. An RCA Sound Specialist is at your service.

RCA SOUND SYSTEMS

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION · CAMDEN, N. J.

LEADS THE WAY... in Radio... Television... Tubes... Phonographs... Records... Electronics

70-6936-137

RCA HOTEL SOUND EQUIPMENT

Amplifier rack—contains radio, phonograph, and microphone, control and selector switches.

Speakers — wall-cabinet and flush-mounted type for inside use; horn-baffle type for outdoor use.

Microphones — dynamic and velocity types in either table or floor-stand mountings.

Intercom units—for intercommunication between key persons and operating departments.

BUY WAR BONDS

HOW TO SELECT POWER DISTRIBUTION

FOR SMALL PLANTS

AS WELL AS THE LARGEST

BUSDUCT

is designed for efficient plant layout and is unexcelled for changing plant conditions.

Architects and engineers have found great, new possibilities in power distribution with FA Busduct — both Feeder and Plugin — for the smallest to the largest plants!

Selection is Easy . . .

Just Remember These Advantages!

The greatest value of Feeder FA Busduct is that it takes up a minimum amount of space for large capacity feeders. Used between generators and switchboards, between switchboards and distribution center, or from the service entrance to the distribution center it assures minimum voltage loss, plus permanent yet flexible service.

Plugin FA Busduct is the answer to *busy* manufacturers. No time is lost when equipment is added or moved . . . just plug-in and go! It reduces shut downs . . . speeds up reconversion! It eliminates tearing up and restringing long, expensive lead-ins when equipment is moved. Saves on Panelboard and Switchboard expansions when load is increased. And it is practically 100% salvageable if moved.

There is a FA District Representative near you. Write for his name and address, or see our catalog in Sweets. His experience in serving small manufacturers as well as the nation's largest companies will be helpful in planning your distribution system.

FRANK ADAM ELECTRIC CO. • Box 357, St. Louis, Mo.

Makers of

BUSDUCT
WIRE & CABLE DUCT
PANELBOARDS
SWITCHBOARDS
ENCLOSED SWITCHES
SERVICE EQUIPMENT

ESV. THE SIGN OF A FA 1981 BETTER JOB

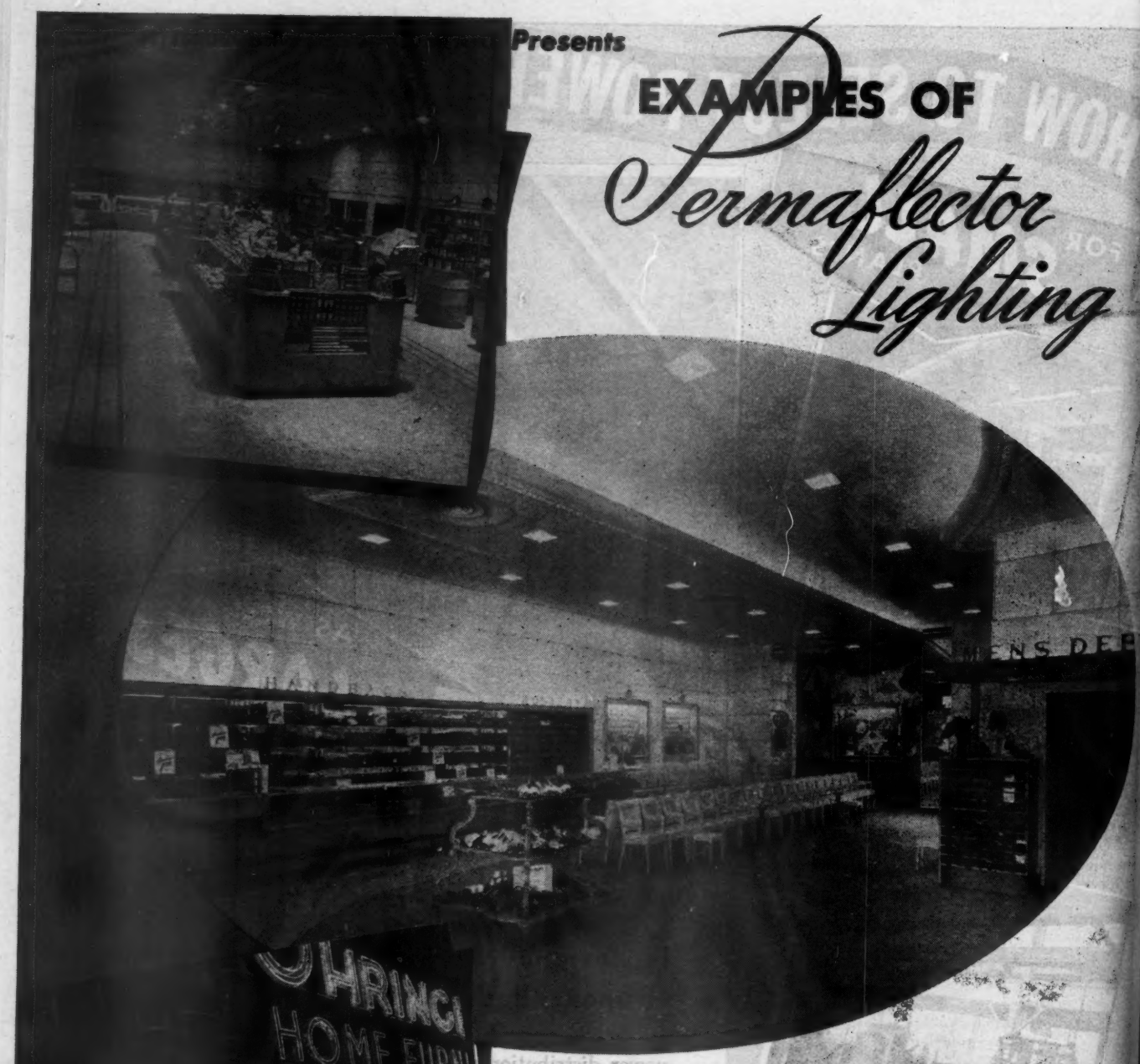
Frank Adam

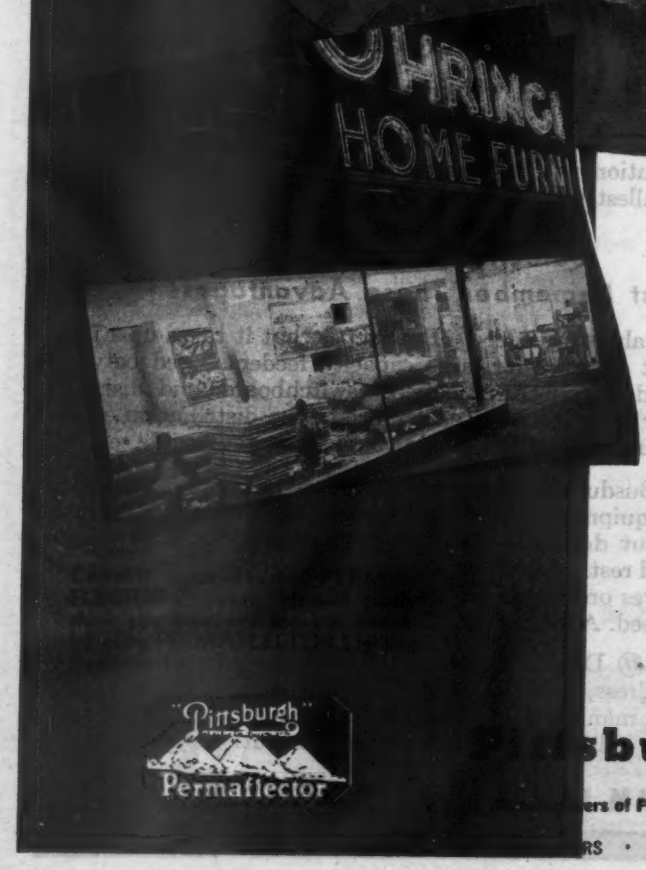
ELECTRICAL PRODUCTS

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

Presents

EXAMPLES OF *Permaflector Lighting*





PERMAFLECTORS... *for Better "See-ability" with More "Sale-ability"*

All-purpose PERMAFLECTORS are adaptable to *all* lighting applications. Whether you need fluorescent or incandescent illumination or a combination of both—you will find PERMAFLECTORS the ideal equipment for your specific lighting requirements.

Illustrated here are three PERMAFLECTOR installations. They are representative of the thousands of outstanding installations throughout the United States in which PERMAFLECTORS have been used to achieve original lighting effects at moderate cost.

Investigate the advantages of PERMAFLECTORS . . . their beauty of design . . . flexibility of use . . . ease of installation . . . low maintenance costs.

Pittsburgh Permaflector

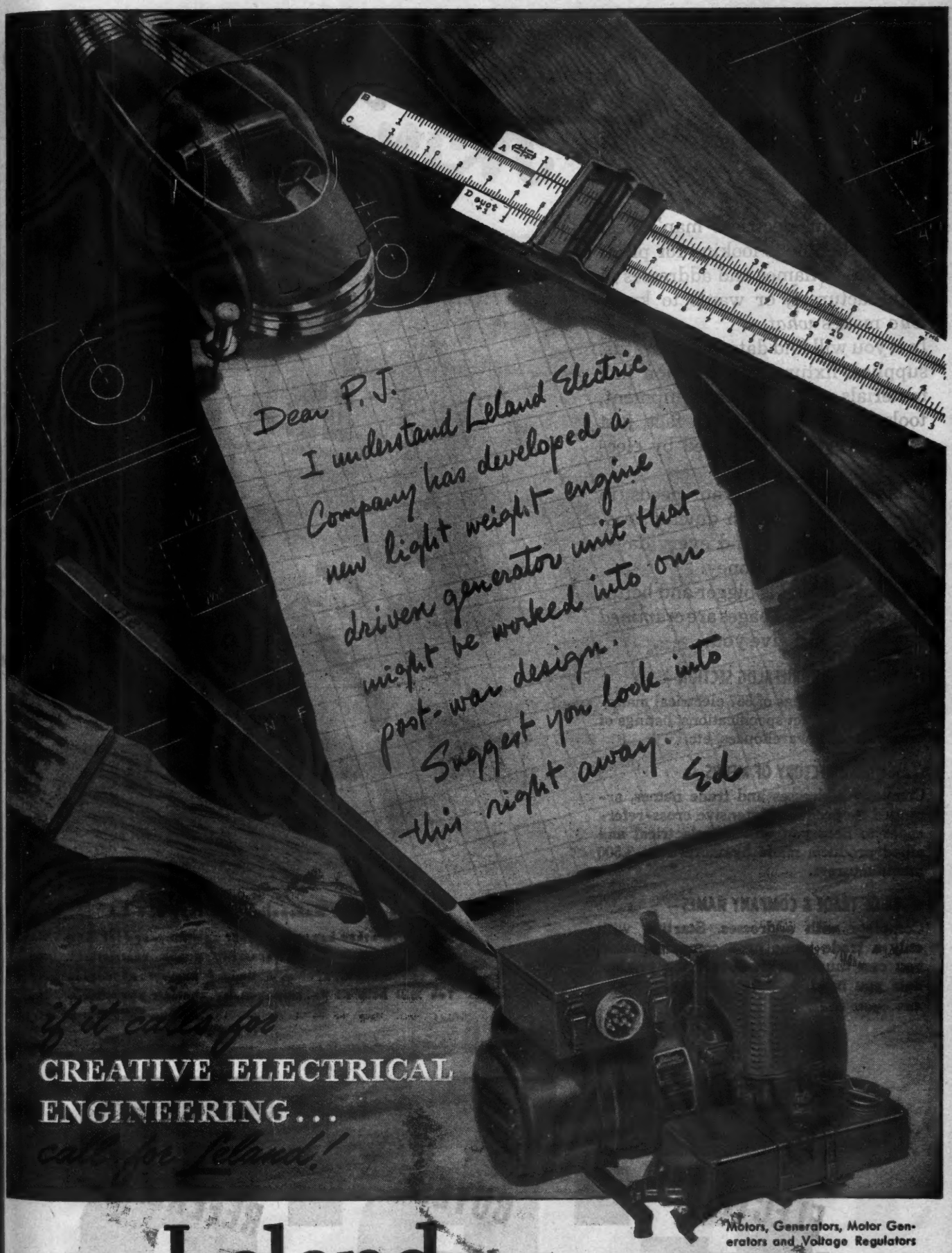
Pittsburgh Reflector Company

OLIVER BUILDING • PITTSBURGH 22, PA.

...ers of Permaflector Lighting Equipment Distributed by Better Electrical Wholesalers Everywhere

Permaflector Sales Engineers in All Principal Cities

...RS • SPOTLIGHTS • FLOODLIGHTS • WIRING DEVICES • FLUORESCENT EQUIPMENT


Dear P.J.
I understand Leland Electric Company has developed a new light weight engine driven generator unit that might be worked into our post-war design.
Suggest you look into this right away. Ed
if it calls for
CREATIVE ELECTRICAL ENGINEERING...
call for Leland!

Motors, Generators, Motor Generators and Voltage Regulators

THE Leland ELECTRIC COMPANY

DAYTON, OHIO • IN CANADA, LELAND ELECTRIC CANADA, LTD.... GUELPH, ONTARIO

Reach first for E-B-R

E-B-R is an electrical man's best friend when he is looking for product data, or names and addresses of manufacturers, or wants to know *who* makes *what.*

In it you will find data on apparatus, supplies, fixtures, distribution line materials, power plant equipment, tools, repair parts . . . in fact, just about every product used by electrical men.

It is designed to fill your needs, to give you information quickly, easily. Use it today—and every day—to save time and money.

The 1945 E-B-R is bigger and better than ever. Its 724 pages are *crammed* with data, and give you:

MANUFACTURERS BRIEFALOG SECTION—
Condensed catalogs of 357 electrical manufacturers. Product specifications, listings of branch offices, warehouses, etc.

CLASSIFIED DIRECTORY OF MFGRS.—
Company addresses and trade names, arranged by product. Extensive cross-references to help you find the electrical and allied products made by more than 3,500 manufacturers.

INDEX OF TRADE & COMPANY NAMES—
Complete with addresses. Starting with only a trade name or a company name, you can thus quickly locate the product data you need.

Please don't monopolize your copy of E-B-R.

Show it to other key men in your company, and let them use it, too. Under government paper restrictions, we can distribute only a limited number of copies. You will help us to help you by sharing your E-B-R.

ELECTRICAL BUYERS E-B-R REFERENCE

McGRAW-HILL PUBLISHING CO., 330 WEST 42nd STREET, NEW YORK 18, N.Y.

Research pays Dividends

When the war came along and we were deprived of our supply of deproteinized rubber we all thought, "Well, that's the end of ANHYDREX until after the war." However, our very capable technical staff came through with an ANHYDREX Buna rubber insulation that we are proud to offer.

This new insulation has a water absorption rate of only .020 grams per square inch of exposed surface. Add to this freedom from electrolysis, installation with or without ducts and you have a combination that's pretty hard to beat.

If you have underground power, control or submarine cable problems that are bothering you, tell your Simplex Engineer about them. He will be more than glad to help you at no obligation whatsoever and you will be assured of getting the latest and most modern engineering advice on your problem.

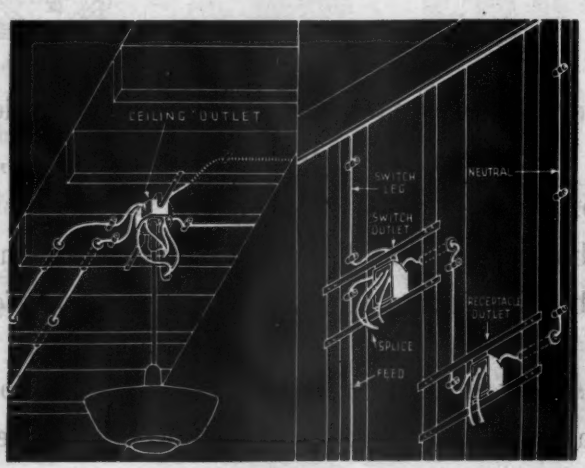
Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex
WIRES and CABLES

Porcelain

THE NATURAL WIRING MATERIAL

MODERN Porcelain Protected Wiring Systems represent an advancement in the science of electrical wiring that can be likened to the new technique of replacing narrow roads with modern separated double-lane highways. They provide for modern wiring, the double-lane safety that is required for modern electrical loads.



The Porcelain Protected Wiring System is based on the principle of employing, for insulation and support, the two best insulating mediums known — these are dry air and porcelain. Another basic principle is the elimination of extraneous conducting elements unless they are absolutely required for protection in areas where severe mechanical hazards exist. Conductors are supported in free air on porcelain supports and in porcelain tubes through building members, for maximum insulation protection and safety.

At points of control and utilization, porcelain outlet boxes and cover devices eliminate the objections found in boxes of conducting materials. They are shock proof, short proof, rust proof, and corrosion proof. Standard knockouts and standard spacing in porcelain outlet boxes take all modern fixtures, switches, convenience outlet and cover devices. No clamps, connectors, or special adapters are required.

The Porcelain Protected System is the only wiring method that provides full circuit insulation and isolation without being dependent upon conductor insulation.

Conductors could be bare, although it is not recommended because all conductors are supported in free air on porcelain. Also, because all conductors are supported in free air, the entire system operates at a lower temperature permitting greater carrying capacities for all conductor sizes as compared to other wiring methods. This differential in carrying capacity starts at about 33% on No. 14 wire and increases to more than 100% on the larger size conductors.

A generous allowance for future load increases should be made so that the occupancy may retain its electrical modernity over a greater period of time. The system is adaptable to practically all wiring plans and layouts.

☆

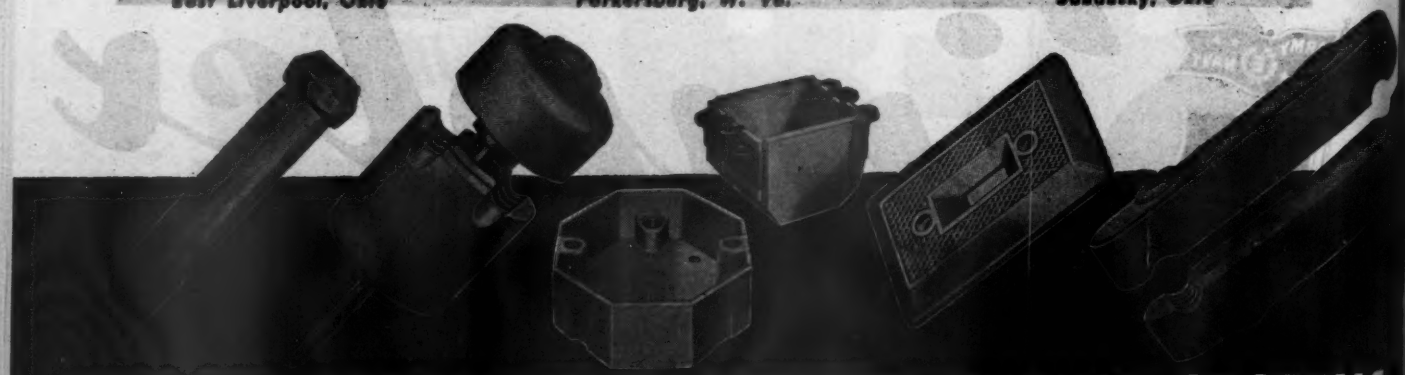
★ ILLINOIS ELECTRIC PORCELAIN CO. — Macomb, Ill.

★ PORCELAIN PRODUCTS, INCORPORATED — Findlay, Ohio

★ SPECIALTY PORCELAIN WORKS — East Liverpool, Ohio

★ SUPERIOR PORCELAIN COMPANY — Parkersburg, W. Va.

★ UNIVERSAL CLAY PRODUCTS COMPANY — Sandusky, Ohio



MODERN PORCELAIN PROTECTED WIRING SYSTEMS

PREVENT COSTLY SHUTDOWNS!

IDEAL
MOTOR MAINTENANCE EQUIPMENT
Keep Motors and Generators "on the job"
Without Dismantling.

For motors and generators that are working overtime, preventive and corrective maintenance are more important than ever! Use IDEAL'S complete line of motor maintenance equipment to overhaul and repair hard-to-replace motors, *without taking them out of service.*

The IDEAL line of motor maintenance equipment includes: IDEAL RESURFACERS to restore commutator and slip ring surfaces "like new", without disassembly. Sizes and grades for all conditions. IDEAL PRECISION GRINDERS for use on surfaces badly scored and out-of-round. Portable—attach to brush arm supports. Run motor, that's all. No dismantling. IDEAL MICA UNDERCUTTERS undercut hardest mica without removing armature.

Ask for the FREE 88-page IDEAL Motor Maintenance Handbook

IDEAL

Branch offices in principal cities • Consult your local Telephone Book

To Keep MOTORS Running
Keep 'em Clean

IDEAL
"3 in 1" ELECTRIC CLEANERS

Cleanliness in motors or other machinery prevents costly shutdowns. Plug an IDEAL Electric Cleaner into any light socket and you are ready to blow or vacuum dust and dirt out of their hiding places in machines and motors. This "3 in 1" Cleaner has Universal full 1 HP motor. Blows clean dry air at a velocity of 24,900 feet per minute, yet at low pressure that doesn't harm the most delicate machinery.

- **BLOW**
- **VACUUM**
- **SPRAY**

1158

PROMPT DELIVERY

CHECK MODERN 4-WAY CIRCUIT PROTECTION

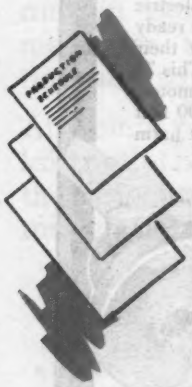
...AGAINST YOUR NEEDS
...AGAINST OLD-STYLE, 1-WAY PROTECTION

Formerly, circuit protection meant one thing only — that too great a current opened the circuit.

But today — Westinghouse AB "De-ion" Circuit Breakers work for you in at least 4 ways. The available special features add many more (shown in the chart). The 4 basic kinds of protection found in all types are:

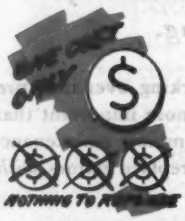
1. MORE POSITIVE PROTECTION for circuits and machines. AB "De-ion" breakers "calculate" both current and time, to give greater safety. They give accurately calibrated, production-tested, automatic protection against severe overloads and short circuits.

2. PROTECTION AGAINST TIME LOST is a double benefit. First, AB "De-ion" breakers do not trip out for brief, harmless overloads—hence, cause no unnecessary stoppages. Second, when they do trip out, machinery goes back into operation faster—by simply flipping a handle. No waiting for replacements . . . for special maintenance attention—to waste manhours needlessly.



3. PROTECTION OF PERSONNEL. Completely insulated enclosures are sealed to protect workers . . .to prevent tampering. Breakers cannot be bridged with nails or coins . . . cannot be blocked closed.

4. PROTECTION AGAINST FURTHER COSTS. One investment is the final cost—for one interruption, or 1000. There is nothing to be destroyed . . . nothing to be replaced.

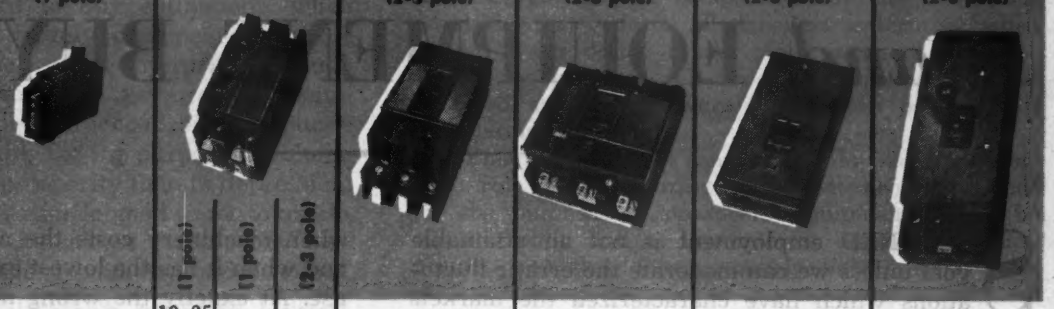


For facts and figures on Westinghouse AB "De-ion" Circuit Breakers, ask your Westinghouse representative for Descriptive Data 29-060. Or write for it, to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60610

Westinghouse

AB "DE-ION" CIRCUIT BREAKERS

WESTINGHOUSE CIRCUIT BREAKERS GIVE YOU 4-WAY PROTECTION—PLUS MANY ADDITIONAL FEATURES



CIRCUIT BREAKER	QUICKLAG (1 pole)	E FRAME (1 pole)	E FRAME (1 pole)	E FRAME (2-3 pole)	F FRAME (2-3 pole)	G FRAME (2-3 pole)	K FRAME (2-3 pole)	L FRAME (2-3 pole)
Ampere Ratings	10–50	10, 25 35, 50	15, 20	10–50	15–100	35–100	70–225	125–600
A-C Voltage Ratings	125	125	277	250	250 & 600	250 & 600	250 & 600	250 & 600
D-C Voltage Ratings	None	125	125	125/ 250	125/250 & 250	125/250 & 250	125/250 & 250	125/250 & 250
Underwriters' Laboratories Interrupting Rating (Amperes)	5000	5000	5000	5000	5000 & 10,000	5000 & 10,000	10,000	10,000
NEMA Interrupting Capacity (Amperes—a-c)	5000	5000	5000	5000	15,000	15,000	15,000	25,000
STANDARD FEATURES — Quick-Make Quick-Break Mechanism	✓		✓		✓	✓	✓	✓
STANDARD FEATURES — Type of Trip: Thermal Only			✓					
STANDARD FEATURES — Type of Trip: Both Thermal & Magnetic	✓				✓	✓	✓	✓
STANDARD FEATURES — Type of Trip Unit: Interchangeable						✓	✓	✓
STANDARD FEATURES — Type of Trip Unit: Noninterchangeable	✓		✓		✓			
STANDARD FEATURES — Adjustable Magnetic Trip					✓*	✓		
STANDARD FEATURES — Nonadjustable Magnetic Trip	✓				✓		✓	✓
STANDARD FEATURES — Magnetic Trip Only					✓	✓	✓	✓
SPECIAL FEATURES AVAILABLE — Non Automatic Features			✓		✓	✓	✓	✓
SPECIAL FEATURES AVAILABLE — ** Shunt Trip Attachment						✓	✓	✓
SPECIAL FEATURES AVAILABLE — ** Undervoltage Release Attachment						✓	✓	✓
SPECIAL FEATURES AVAILABLE — ** Bell Alarm Switches					✓	✓	✓	✓
SPECIAL FEATURES AVAILABLE — ** Auxiliary Switches					✓	✓	✓	✓
SPECIAL FEATURES AVAILABLE — Electrically Operated							✓	✓
SPECIAL FEATURES AVAILABLE — Mechanical Interlock			✓		✓	✓	✓	✓

*Magnetic trip only—thermal omitted.

**These devices are mounted inside the breaker case, and require no additional space.

STEADY JOBS *and* EQUIPMENT BUYING

SUSTAINED employment is not an attainable goal unless we can moderate the erratic fluctuations which have characterized the markets for producers' equipment in past periods.

In the 35th editorial of this series, "Sustained Construction Activity", it was pointed out that there is no specific that can cure our economy of its "boom-or-bust" proclivities. Rejecting the notion that the construction industry could be so managed as to stabilize business as a whole, that editorial stressed the important contribution it could make to that end, and suggested several practical expedients through which construction activity might be regularized.

Producers' equipment represents an area of production quite as broad and diverse as construction, though smaller in aggregate value. The classification embraces all types of durable equipment bought and used for profit—locomotives, motor trucks, electric generators, conveyors, machine tools, farm implements, and so on down to surgical instruments and dentists' drills.

Although the output of such equipment averages over a long period only 5 or 6 per cent of the nation's total output, it resembles construction in its extraordinary ups and downs. While its component items differ widely in the amplitude and violence of their fluctuations, the class as a whole is one of the most unstable sectors of the economy, making therefore a quite disproportionate contribution to the cyclical swings of total production and employment. From 1929 to 1932, for example, the decline in the output of producers' equipment (at constant prices) was 65-70 per cent, in contrast to a decline of 25-30 per cent in the national output exclusive of such equipment and construction.

A more recent example of the volatility of demand in this field may be found in the movement of a monthly index of orders for industrial equipment, which rose from 92 in the spring of 1936 to 160 in the spring of 1937, falling thence to 65 in the summer of 1938 and rising again to 142 in the fall of 1939. Such fantastic oscillations present an obvious and inescapable challenge to all concerned with economic stabilization.

Not only are these fluctuations bad for the economy; they represent demonstrably bad buying policy on the part of the purchasers of equipment. Peaks in demand come characteristically just before a business depression (1919, 1929, and 1937, for example) when machinery costs the most to buy and install and when it has the lowest expectancy of continuous use. At exactly the wrong moment everyone wants to buy. In the depression itself, on the other hand, with costs down, and with nowhere for the economy to go but up, equipment is a drug on the market. No one wants it when it is cheap and has the greatest prospect for steady employment. Here is a behavior pattern so profoundly irrational there must be hope for its correction.

There is an inveterate tendency for business management to forecast the future simply by projecting the trends of immediate past. Although it is axiomatic that the chance for an extended period of further prosperity is inversely related to the duration of the prosperity already experienced, this truism is generally ignored. The longer the boom has run, the more certain is business management that it will continue indefinitely. Convinced at last by "actual experience" that prosperity is here to stay, executives give the green light to commitments for expansion and modernization previously deferred in a skeptical attitude of "wait and see". The result, so often repeated in our economic history, is an explosive burst of demand for equipment coincident with, and contributing to, the final spasm of a boom. Witness the phenomenal rise in industrial equipment orders during 1928 and the spring of 1929.

The same prophetic illusion works in reverse during a depression. Recent experience is projected into the future. Although the mathematical probability of an imminent and prolonged period of prosperity increases directly with the duration of a depression, it finds little reflection in business decisions. Timidity and caution are the order of the day.

Compounding the errors caused by faulty perspective, are a number of influences which make it extremely difficult for individual enterprises to follow a policy geared to sensible long-term considerations. In a boom, particularly in its climactic phase, most producers find their order books crowded beyond the potential of their current capacities and are faced with the alternatives of expanding or losing trade to competitors. In depression the situation is reversed, and producers with unused facilities find it difficult to justify increases in their capital charges.

An even more controlling factor in many cases is the availability of funds. This is especially important

for small concerns. Typically such firms enjoy but limited credit, and with no ready access to the securities markets, their capital expenditures depend primarily on earnings. When they are making money, they can afford to buy equipment; when they are losing, they largely disappear from the equipment market. Even great enterprises, though less dependent on earnings as a source of capital financing, are profoundly influenced by the volume of internal funds available for the purpose, a volume as a rule far greater in prosperity than in depression. Moreover, it is usually easier in good times to obtain outside funds through the sale of stock or by borrowing, since in bad times bankers, underwriters, and investors are susceptible to the same timidity and caution that afflict business management generally.

We are dealing here with a combination of psychological, physical, and financial forces which conspire to aggravate the instability of demand for capital equipment. What can be done to reduce this instability and thus to bring equipment purchasing into a more sensible and constructive pattern?

There is no panacea, no royal road to the solution. The problem has been with us since the beginning of the industrial economy. It is complex and difficult. It is not, however, wholly intractable. We may reasonably hope that industry will, through intelligent effort, make substantial progress toward a satisfactory solution. The industrial equipment field is one in which government, except for war periods, has exerted little direct control. The best insurance against the institution of government measures is to so conduct activities in the equipment field that no justification for government interposition can be made.

☆ ☆ ☆

1. The first and most important step is for industry itself to reconsider its heretofore haphazard and opportunistic policy in the purchase of equipment, substituting so far as possible a regularized, long-range programming of expenditure that will resist both the excited long-buying of booms and the equally disturbing underbuying of depressions. Such long-range programming is particularly appropriate and advantageous for large enterprises in established industries such as railroads, electric power, steel, automobiles, and the like, but it makes sense much more generally.

Once executives come to realize that a reasonably stable equipment program contributes not only to the welfare of the economy but also to the lowering of their long-run equipment costs, the opportunity to combine a public service with private advantage should induce them to recast their policies accordingly.

There is an even more compelling reason for purchasers of industrial equipment to do everything possible to regularize their demands. Some concerns unquestionably will find themselves in a postwar position where speedy delivery of needed equipment, even though it involves the payment of premium prices, will seem to be justified. But there is no system of accounting that can show it to be a profitable transaction to promote an equipment industry boom that runs a brief course only to collapse when the backlog of deferred maintenance and development has been satisfied. That, historically, has been the trigger which trips the door to the depression phase of the business cycle. No immediate advantage can compensate for the contagious paralysis that infects all business enterprise when major layoffs occur in any major segment. No precautionary measures, self-imposed by business, can be regarded as unduly severe if they can prevent this devastating blight.

2. Financial agencies can and should play a responsible role in regularizing equipment demand. Funds for the purchase of producers' equipment should be offered boldly and at low interest during depression periods, and should progressively tighten as a boom market bids up the price of purchase and installation. Banks and financial houses have excellent facilities for gathering and interpreting market and general economic information. It is good business for them, and for the national economy, to exercise their accepted discretions in a manner that will help to promote economic stability.

3. There now is almost universal recognition of the need for a thorough-going revision of our corporate tax structure to the end that effective incentives may be offered for private capital investment. The possibility of including provisions which would offer special tax concessions to equipment investments made in depression periods is worthy of intensive exploration.

☆ ☆ ☆

The fundamental problem here is educational. If all business enterprises in a position to do so were to regularize their equipment expenditures, it would have a tremendously beneficial effect. True, it would accomplish no miracles. For many concerns it is not feasible to schedule equipment buying over a long period. Even those who do schedule it are likely in practice to attain only a relative stability. It must be acknowledged, moreover, that few programs could withstand indefinitely a very deep and prolonged depression such as we had in the thirties. Nevertheless the adoption of stabilization policies where feasible would make a signal contribution both to the restraint of booms and to the mitigation of depressions. Here is something industry can do for itself.

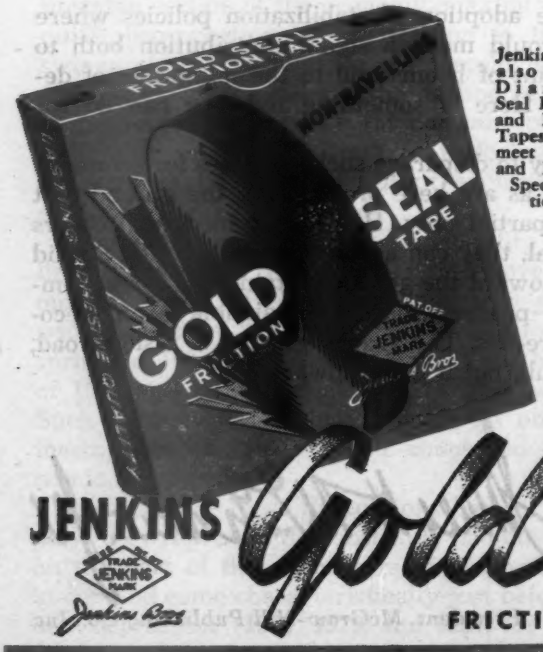
It is easy to disparage such remedies for economic instability as are here proposed on the ground that they are partial only. However, joined with others also partial, they can achieve in combination a solid progress toward the goal of sustained high level employment—progress that is unattainable through economic cure-alls. The road suggested is a slow road, and difficult, but it leads upward.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

THIS IS THE 37TH OF A SERIES

He's no more flabbergasted than we'd be . . . if a dried-up roll of Gold Seal Tape showed up!



Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications

NOT A SINGLE THING is left to chance in the production of Jenkins Gold Seal Tape.

Every batch of friction compound is thoroughly lab-tested. Tensile strength of every bale of base cloth is periodically checked. Processing is scientifically controlled every step of the way – right up to the moment when the roll is crisply wrapped in cellophane and tucked in its sturdy red box.

That's why Jenkins Gold Seal Tape doesn't dry out, ravel, or peel like ordinary tape. That's why it sticks to the job instead of the hands . . . why it always reaches you factory-fresh . . . why Gold Seal Tape is your best tape buy. Jenkins Bros., Rubber Div., 80 White Street, New York 13, N. Y.

JENKINS *Gold Seal Tape*

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

JULY . . . . at a Glance

FOR SPECTACULAR WIRING problems, few jobs offer more complexities than one of the huge wind tunnels used by aircraft designers for aerodynamic tests. George Stone's article on the wiring of the new wind tunnel at the California Institute of Technology shows many of the unique problems involved. The job ranges from a 10,000 hp. motor to intricate control and instrument circuits. It's our lead story this month on page 59

★

HOUSE WIRING in the coming years is going to account for a big chunk of wiring business. Industry practice has always tended to over-simplify the estimating and accounting problems in handling house wiring operations. Yet, the profitable handling of residential work is a highly specialized and difficult game. Certainly there is no field of electrical work where rule of thumb estimating practices have been so common and so disastrous. A system originally developed many years ago has been brought up to date by Ray Ashley, Research Engineer for the Chicago Electrical Contractors Association. His thorough going study of residence wiring estimating appears on page 64. Estimators will find it a well founded and accurate basis for lining up their own estimating practices for the large residential business to come.

MANY OF THE new developments in lighting applications have appeared first in some modest little restaurant. And much lighting progress has come through public interest in lighting stimulated by unusual lighting techniques applied in some eating place. The field for lighting application in restaurants postwar is practically unlimited. Almost every contractor has several such prospects waiting for the release of lighting and wiring equipment. Berlon Cooper's lighting techniques article this month deals with modern lighting methods as applied to restaurants. This useful background material will be found on page 69.

★

BEHIND THE CHINESE WALL of professional ethics, anesthetic explosions in operating rooms in the past got little public notice and often less consideration from engineers. In recent years, however, a lot of work has been done. Glenn Rowell, of Fire Underwriters Inspection Bureau of Minneapolis, has worked with prominent physicians to study the complex electrical problems arising from the use of highly explosive anesthetics. With thousands of veterans returning to hospitals in this country, the modernization of operating rooms, in line with sound electrical design to avoid explosion hazards, will be an important job for our industry. Rowell's practical and informative explanation of the hazards involved and the proper electrical safety measures which should be used, appears on page 72. It is a must for everyone concerned with the design or installation of wiring in hospitals.

★

YOU CAN'T GLAZE a bathtub with infra-red lamps, but curing and drying in the preliminary process of manufacture has been greatly speeded by replacement of natural drying methods with an infra-red process. The application of infra-red to pottery manufacture has been studied and applied at the Pottery Company of Trenton with excellent results from the cost standpoint. The story is on page 75.

Because of the basic importance of adequate wiring to the entire electrical industry, Anaconda is presenting messages like this in a wide list of national publications.

DON'T BE PENNY-WISE AND POWER-FOOLISH

You'll want all the production capacity possible from new, improved electrical equipment. Then don't let inadequate wiring rob you of equipment performance you pay for. Assure sufficient current for efficient operation of future electrical apparatus.

Remember, wiring won't stretch. Check up on your wiring plans *now!* It's far wiser to change blueprints than risk costly alterations later. This is the time to call in consulting or plant power engineer—electrical contractor or power salesman. They'll advise *foresighted* wiring. Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company. General Offices: 25 Broadway, New York City 4. Chicago Office: 20 North Wacker Drive 6. Sales Offices in Principal Cities.

Get the performance you pay for in modern equipment—

Wire ahead

You wouldn't accept equipment that performed only part way—then why let inadequate electrical wiring cut production efficiency?
HELP BRING VICTORY SOONER
... BUY MORE WAR BONDS

ANACONDA WIRE & CABLE COMPANY

FUTURE MANPOWER

Manpower is the life blood of industry. The future of this great game is going to depend pretty much on the caliber of men we attract and train for the years ahead. Especially important are the young men, apprentices, clerks, draftsmen or assistant engineers. Eventually from the ranks of these beginners will come the forward looking ideas and the high skills which, with mature experience and judgment, make for industry progress.

It won't be long before millions of returning veterans will be spreading out over the country, each seeking out his own niche in the economy. Some will return to their old jobs. Most, however, will be looking for new ventures and new careers. And the men of vision and vigor, of skill and spirit, among them will want opportunity most of all.

Are there sound prospects and real opportunities in electrical construction, installation and maintenance for these men? Are there jobs that good men can build their lives around? Are there careers to inspire the imagination and absorb the energies of top grade talent? Certainly there are. And looking at the quick tempo of new electrical development, we are going to need the highest order of skill and brains to ride herd on this industry in the days ahead.

But our future manpower won't be knocking on our doors as highly trained, experienced and skilled answers to our urgent needs. They'll come as applicants for jobs, green, untrained and uncertain in most cases of just where they are going. It is going to be up to us to recognize their potential qualities, to inspire and train them, and to open the doors of opportunity.

However apparent the need for bringing in and developing a high order of new talent and however obvious the current opportunity to select from a vast pool of top grade resources, there is today a woeful lack of plan or action toward doing anything about it. If we want the best men, they must be sought out and purposefully directed with our long range objectives clearly in mind.

Minimum essentials will include an organized liason with local veteran service bureaus staffed by a counsellor of keen judgment. And behind him should stand a committee of top flight men of both management and labor; men who, by their own experience and personal example, can inspire and direct the visions and ambitions of the kind of men we want to bring in to this industry.

By and large, the machinery for directing veterans back to their old jobs is pretty well organized. But future manpower is going to be built from new men too. The opportunity will be before us soon to select, inspire and develop the industry leaders of tomorrow. And the way we handle our responsibility now is bound to establish the quality of that leadership.

Wm. F. Stuart.

Electrical Contracting

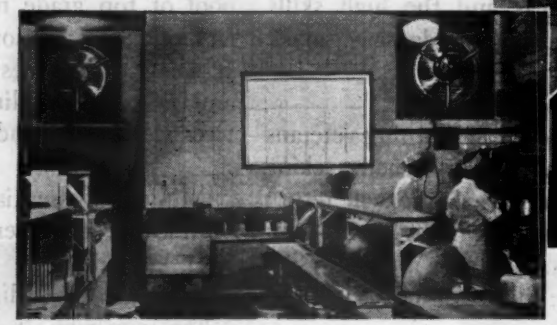
JULY, 1945

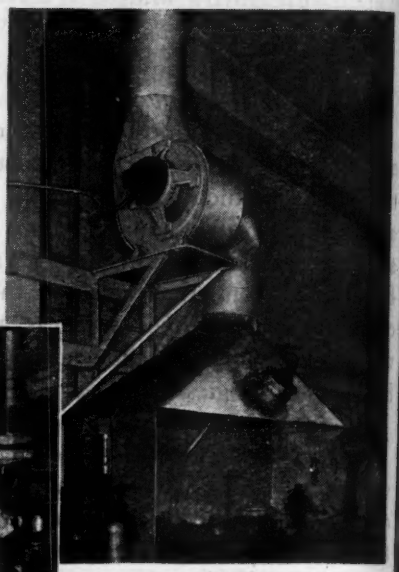
THE ELECTRICAL SIDE OF

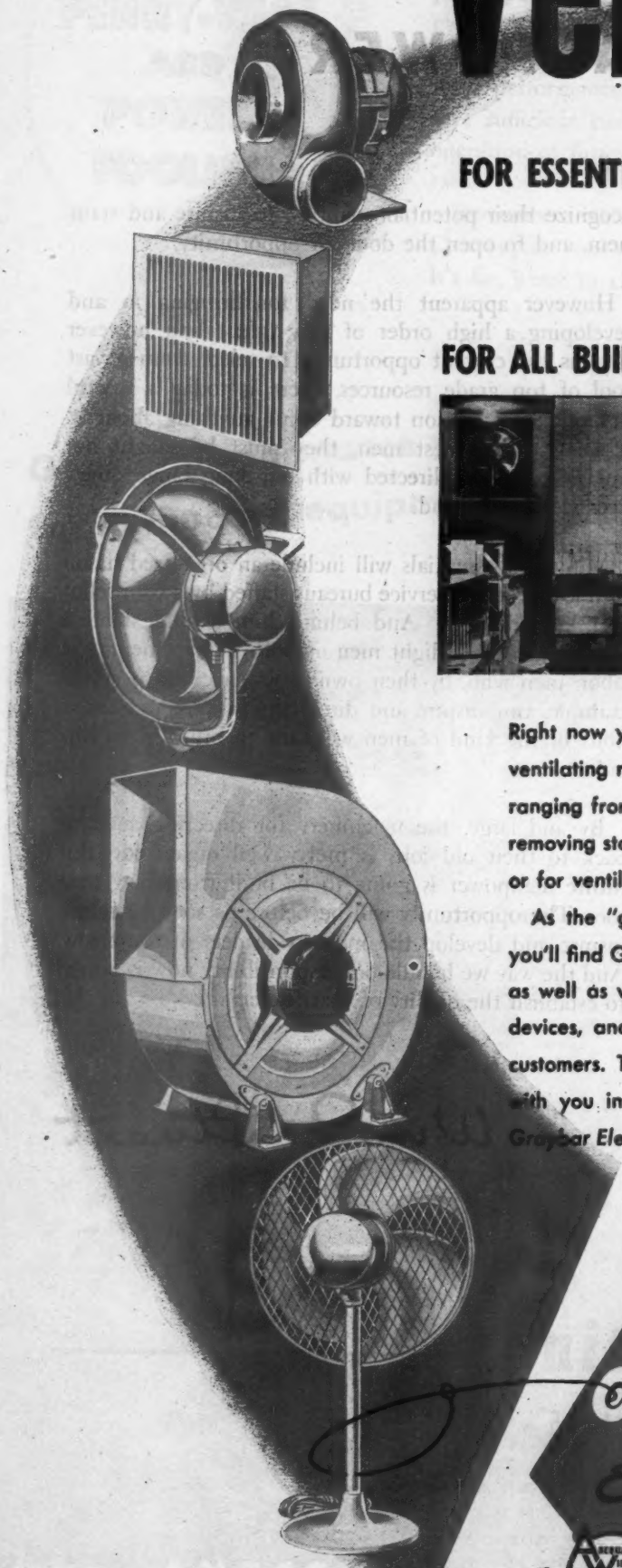
Ventilation

FOR ESSENTIAL JOBS *NOW*

FOR ALL BUILDINGS *SOON*







Right now you can obtain Ilg apparatus via Graybar to meet the ventilating needs of any of your war-plant customers. Suitable units, ranging from wall fans to large centrifugal types, are available for removing stale air, fumes, dust, or excess heat from a single room — or for ventilating an entire building.

As the "go" signal is given to construction and modernization, you'll find Graybar ready with the latest Ilg ventilating apparatus — as well as wire and cable, motors and controls, lighting, signaling devices, and other electrical supplies — for the needs of all your customers. Then, as today, a Graybar Specialist will gladly work with you in selecting and supplying the best items for each job.

Graybar Electric Company, Graybar Building, New York 17, N. Y.

4559

Via GraybaR

— serving the Nation's Electrical Contractors

ADEQUATE WIRING THE KEY TO THE HOME OF TOMORROW

IN OVER 80 PRINCIPAL CITIES

Caltech wind tunnel will incorporate the most advanced technical improvements and will provide wind velocities up to more than 700 mph.

We Wired A WIND TUNNEL

Los Angeles Electrical Contractor ties in with a $2,500,000 project—the kind of wiring job that comes "once in a lifetime". Eighteen months spent in contact with one of the outstanding scientific developments of our time.

By George B. Stone

Manager
Pacific Electrical & Mechanical Co., Inc.
Los Angeles, San Francisco and Seattle

IN Pasadena, Calif., the project known as the Southern California Wind Tunnel is completed and in operation. Under the impetus of wartime necessity, four manufacturers of the traditionally highly competitive aircraft industry have financed and own this tunnel, a $2,500,000 facility for the improvement of aircraft design. They are Consolidated-Vultee, Douglas, Lockheed and North American. They will continue in peace the elements of wartime cooperative development. The tunnel was constructed by the California Institute of Technology as agent, under Director Dr. Clark B. Millikan, that institution now operating the tunnel in behalf of the four companies.

Size of the cooperative tunnel had to be such as to make the test of large-size, complete airplane models relatively simple. Operating conditions had to be such as to cover speeds up to the velocity of sound. Accuracy had to be extremely high and the time to make any individual test and obtain complete data had to be held to a minimum. Wide flexibility in the type of test which could be conducted, and the transition from one project to another

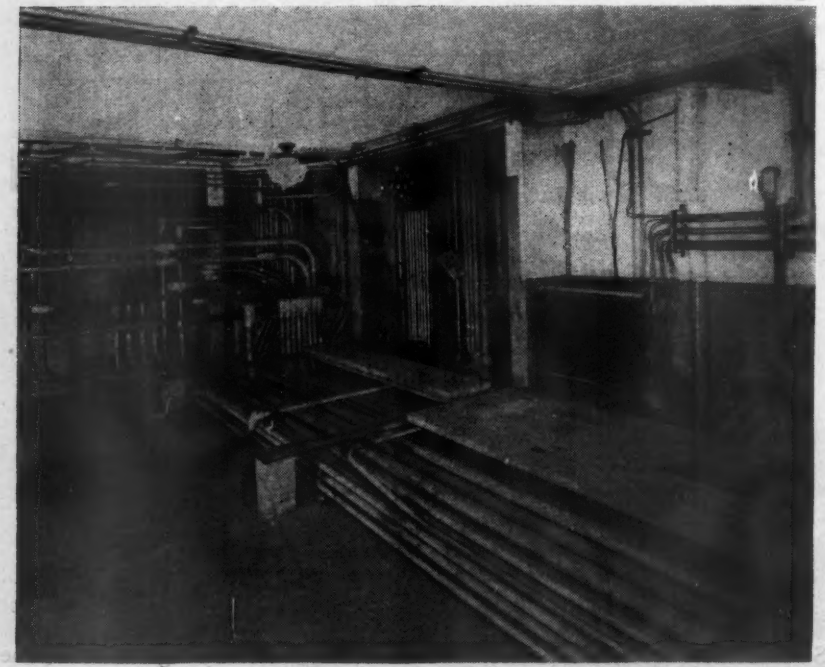
had to be rapidly and easily made.

Great ingenuity and the utmost complexity of operating and control features characterize the tunnel. These controls called for the installation of electrical circuits and equipment far different from those met by the electrical contractor in the usual lines of work, as we soon ascertained.

This was a completely developed job as it came to us, and thoroughly engineered. But because of the fact that many things could not be put on paper before the equipment arrived from the manufacturers, the job was characterized by rather more than the average number of current field problems and delays.

We did this work under two contracts. Contract No. 1 was for the power plant building and laboratory building, and was a firm contract. Contract No. 2 was for the wind tunnel proper and the control wiring between the wind tunnel, power plant building and laboratory building. This was on a cost plus and guarantee maximum basis, the owners furnishing the material in this case. The total value of the two contracts was in excess of $125,000 including material. From the start of the first contract to completion of the second, the elapsed time was approximately one and one-half years. We had from six to 16 men on the job most of the time, and did all the wiring with one exception. The International Business Machines Corporation wished to make its own hook-up of the equipment it furnished, so we merely pulled the wires necessary for that purpose.

It is not possible in this article to give more than a bare outline of some of the features of the tunnel and how it operates. The photograph of the phantom drawing gives the best general conception of it. Operation is under variable speed and variable density conditions of the air passing through. The air stream is brought to bear on a model mounted in the spherical test chamber seen near the center of the drawing. The mounting of the model (either a complete plane or some element of one) is such that all the forces and moments acting on it, at various "attitudes" with respect to the direction of the air stream—that is, the angle of attack and angle of yaw, etc.,—can be measured and transmitted to instruments located in the control room seen in the lower left hand corner. It is not necessary, even, for the observers to record these data manually, as they are transmitted continuously from the interior of the test chamber. Through a group of automatic measuring and recording machines installed by the I.B.M. Corp. these data are recorded on both tapes and punched cards, doing away altogether with the human element in observing and recording.



Conduit for the control circuits come in from under the catwalk and pass to a point under the control room, thence upward and into it to the console. The concentration of pipe here, in what is known as the sub-control room, is partly rigid and partly tubing. The floor runs are covered with removable planking, removed here for the purpose of the photograph.

Support of the model under test in the sphere is of three types and carried on tables. When a table is in position in the sphere, the model to be tested is attached to the force measuring or metrical system and all contact between the model and table is severed. The forces which the air current exerts on the model are thus transmitted to the metrical system, which separates them into components and measures their magnitudes. This system, which weighs over 50,000 pounds, floats on thin films of oil and measures to the fraction of a pound, by means of hydraulic capsules or gages, dials for which are located in the control room.

Tests are carried on under conditions varying from four atmospheres (44.1 psi) to ¼ atmosphere (3.6 psi). The tunnel is 179 ft. long, from end to end of the rectangle, with a maximum diameter of 31.5 ft. Considerable time is required to bring it to these pressures, and it is plain that when tests are completed on one model, there would be a waste of time to "inflate" or "deflate" the whole thing in order to take out one model and set up another at atmospheric pressure. So the testing sphere was devised, which, by controlled gates with hermetic sealing features is connected with the two sides of a bulkhead within the tunnel. The relatively small sphere can thus be isolated and brought to atmospheric pressure in a relatively short time, leaving the pressure within the bulk of the tunnel undisturbed. The model, reconnected to the table, is then moved out on a track and another one, previously set up for test in the room to the left of the control room, is moved in. Previous set-up of the models in this way means that the tunnel can be kept in operation almost continuously, not only economically sound, as applied to any expensive piece of machinery, but greatly speeding up the testing work.

Requirements of the fan system are severe. It must operate at highest possible efficiency over the entire range of tunnel pressures and be able to absorb the entire power input of the 12,000 hp. drive. The flow of air at all times must be purely axial in direction and reasonably uniform over the cross-section of the tunnel.

The flexible fan arrangement to do this, operating at a maximum of 595 rpm, consists of two identical stages and a set of flow straightening vanes, located downstream of the second corner of the tunnel. Each stage has 12 stationary prerotation vanes and a set of 16 fan blades, with detachable

For control circuits alone, approximately 15,000 feet of one-inch tubing was required. Photograph shows method of handling this type of conduit. Note flexible conduit over the light. Conduit support is rigidly welded to tunnel. To keep vibration of tunnel from building, the flexible link was inserted.

coupling located between the two fan hubs. The first stage alone, or both stages, can be operated. The prerotation vanes are equipped with adjustable, 30 percent trailing-edge flaps. The pitch of the fan blades can also be adjusted. All these adjustments are made by remote electrical control from the control room.

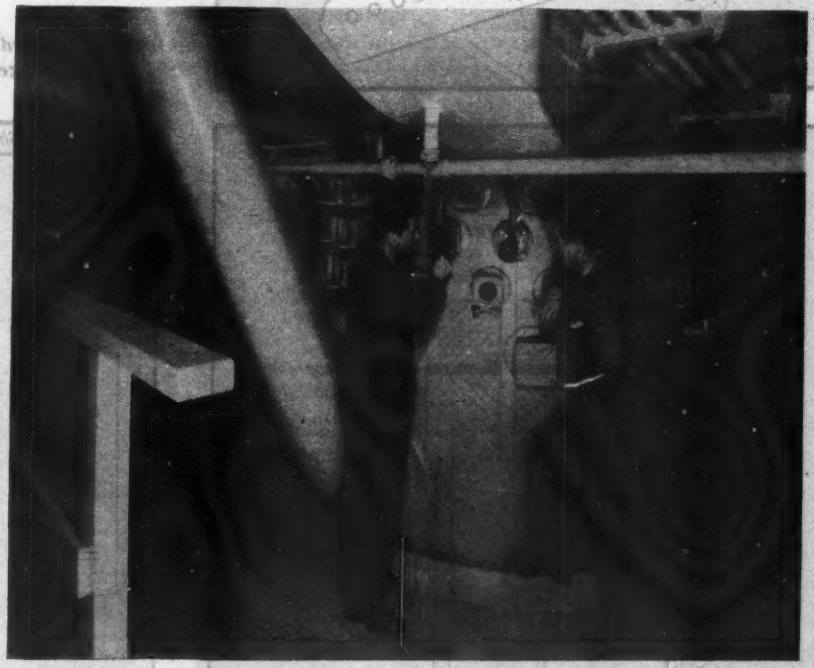
Actuating power, control and indication of flap and pitch changes are supplied by an external pitch control system, an assemblage of electric motors, miter gear units, magnetic clutches and special gear boxes mounted on a concrete foundation on the floor near the fan section. A temperature indicator and thermoswitch are mounted in the case of each roller bearing, giving a remote reading at the console, the thermoswitch stopping the main drive if the oil temperature exceeds 190 degrees F.

The fan system is driven by a two-element electric motor-set with a peak rating of 12,000 hp. The basic drive of the set is a variable speed d-c motor supplied through a separate motor generator directly coupled to and driven by an a-c motor of the synchronous type. These three machines have a top rating of approximately 2000 hp. at 570 rpm. Power requirements above the capacity of the d-c system are supplied by an a-c variable-speed, induction motor having a wound rotor and slip rings and a short-time capacity of 10,000 hp.

This split system of drive was devised to take advantage of standard, commercially developed machines, providing flexibility and reliability at low cost.

One of the functions of the direct-current component in the system is to enable a quick slow-down of the air in motion in the tunnel by means of absorbing power back into the electrical system through provisions for regenerative feed-back, occurring when the fan is driven at a speed substantially below that corresponding to its propellor progress with the then existing air flow. The propellor thus functions as a turbine to pump electrical energy back into the supply system. This is desirable especially at high densities since the comparatively large amounts of energy are stored in the high-speed wind stream, which must be stopped before the procedure of a quick change in the model rigging may be affected.

Another important requirement for testing is met by the adaptability of the d-c machines to a modern electronic speed regulator with which this drive is equipped. Thus, the system covers the lower half of the speed range independently, does its share in the upper end of the loading and regulates to stabilize and maintain precise speed at any setting, besides functioning as a brake. The duty of the induc-



An ingenious type of box was designed to pass circuits from the outside into the inside of the tunnel, which latter is either under pressure or in a state of partial vacuum. Fittings are located at various points over the tunnel shell, most went through this pot directly under the spherical test chamber.

tion motor is to carry the major load over the upper half.

Electricity is purchased wholesale from the Pasadena municipal light plant. Service is brought to the laboratory underground through a 17,000 volt cable. At the wind tunnel substation the voltage is stepped down to 2300 volts for use in the main machinery. In a separate transformer bank in the same station it is reduced to 440 volt for auxiliaries and for supplying local transformers feeding small power and light circuits.

The system of control provides for centralized operation at a master control console by means of remote control and indication circuits. With the exception of selection of type of operation and required speeds, all functions are automatic. This involves the extensive use of interlocking and interpretive relays and contactors.

It will be seen from the above highlights of this remarkable installation that in addition to the ordinary wiring for power and light purposes there are innumerable control circuits interlaced between the control room, tunnel, power plant and other parts of the buildings.

As a consequence, it was necessary for us to install approximately 15,000 feet of one-inch Steeltube, to accommodate the control circuits alone. A large portion of this is located between the power plant and the control board in the control room and under a catwalk situated along the end of and down one side of the building as shown in the photograph. The method of supporting this part of the conduit system is shown in Fig. 1. Steel hangers were used, being ⅜ inch rods from the under side of the catwalk.

These hangers were welded to angle iron cross supports. The hangers proper consist of two by fours having longitudinal rows of holes to receive the conduit, the timber being ripped through the center of the line of holes to facilitate installation. The two by fours rest on the angle irons as shown and after placing the conduit the assembly is held together and rigidly on the angle iron by bolts.

Some of the wiring for control circuits as well as light and power circuits had to be carried into the tunnel and the sphere. Due to the variations in pressure inside during tests, it was necessary to provide means whereby the wires could be carried through the shell without leakage into or out of the shell, or sphere, depending on whether the test is being conducted at above or below atmospheric pressure. Fig. 2 shows the interesting manner in which this was done.

Metal boxes are welded over openings in the shell. Insulating plates with gasket between are provided, through which pass metal pins with

[Continued on page 202]

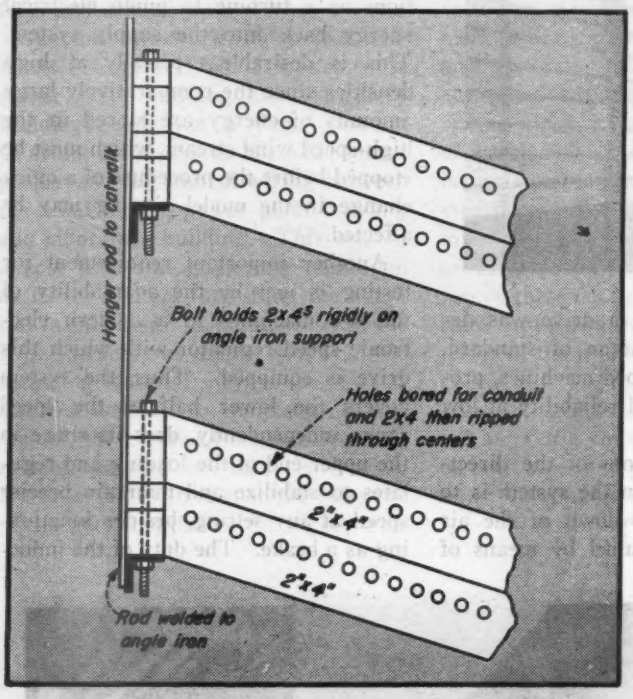

Hanger rod to catwalk
Bolt holds 2x4s rigidly on angle iron support
Holes bored for conduit and 2x4 then ripped through centers
2"x4"
2"x4"
Rod welded to angle iron

FIG. 1—Type of conduit rack supporting tubing for control wires under catwalk. (Left)

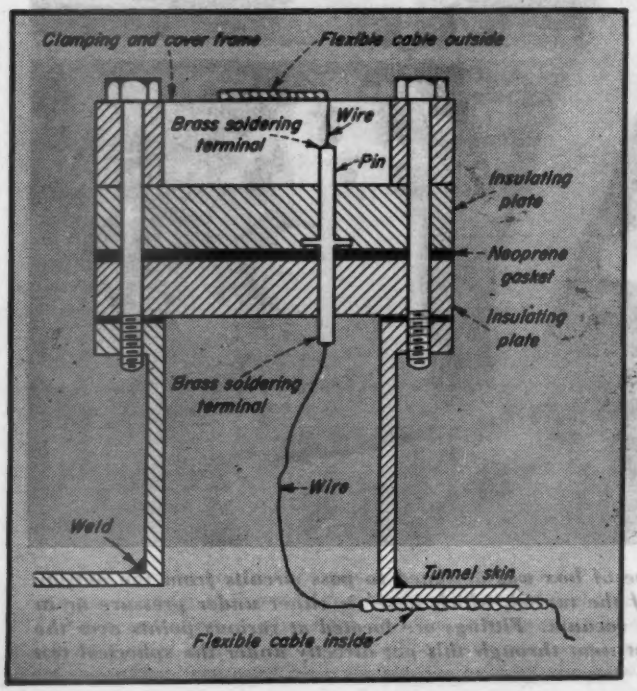


FIG. 2—How circuit connections are brought through tunnel wall. Fittings have from 19 to 31 pins.

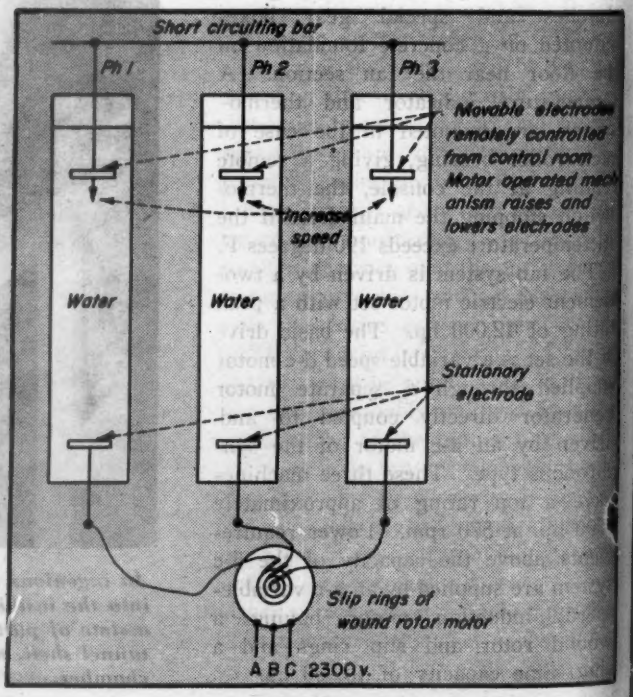
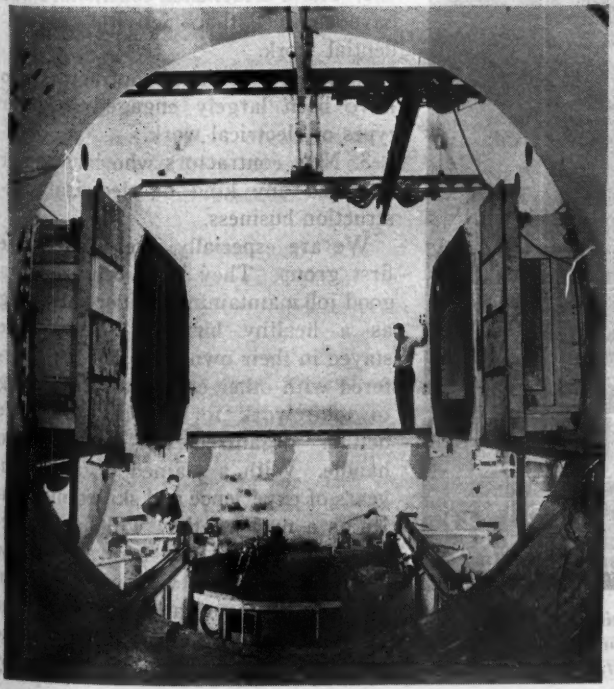


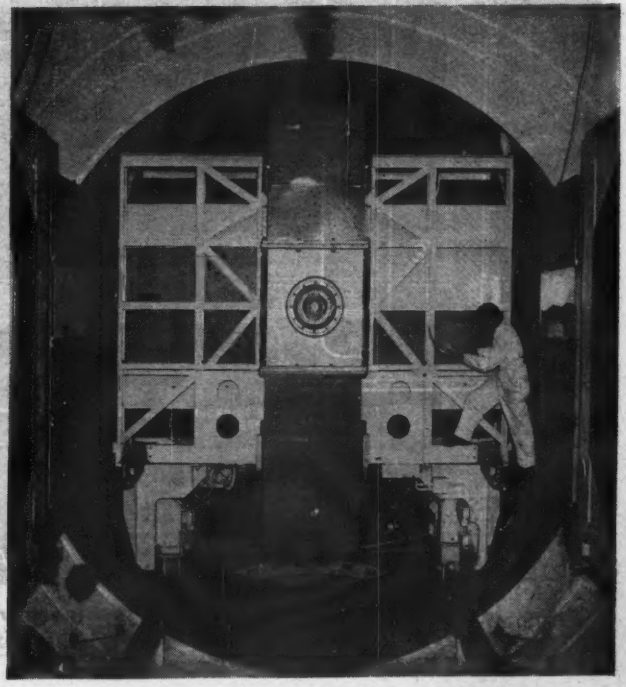
FIG. 3—Hydraulic rheostat connections on speed control for the large motor. (Below)

Main drive power plant for the dual fan. At left is a 10,000 hp. alternating current motor direct connected to a 2000 hp. direct current motor. At right is a portion of the m.g. set providing d-c.

Inside of the section with the 31½ foot decompression sphere. (Lower left)

Model table is shown here halted just inside the decompression sphere opening which contains the working section of the wind tunnel. It is not yet in position for testing to proceed. The airflow is from right to left in this photograph.





ESTIMATING RESIDENTIAL

Intelligent appraisal and accurate estimating can make residential wiring a profitable business. The "Four Unit System" described herein paves the way for accurate cost determination.

By Ray Ashley

Research Engineer
Electrical Contractors Association of City of Chicago

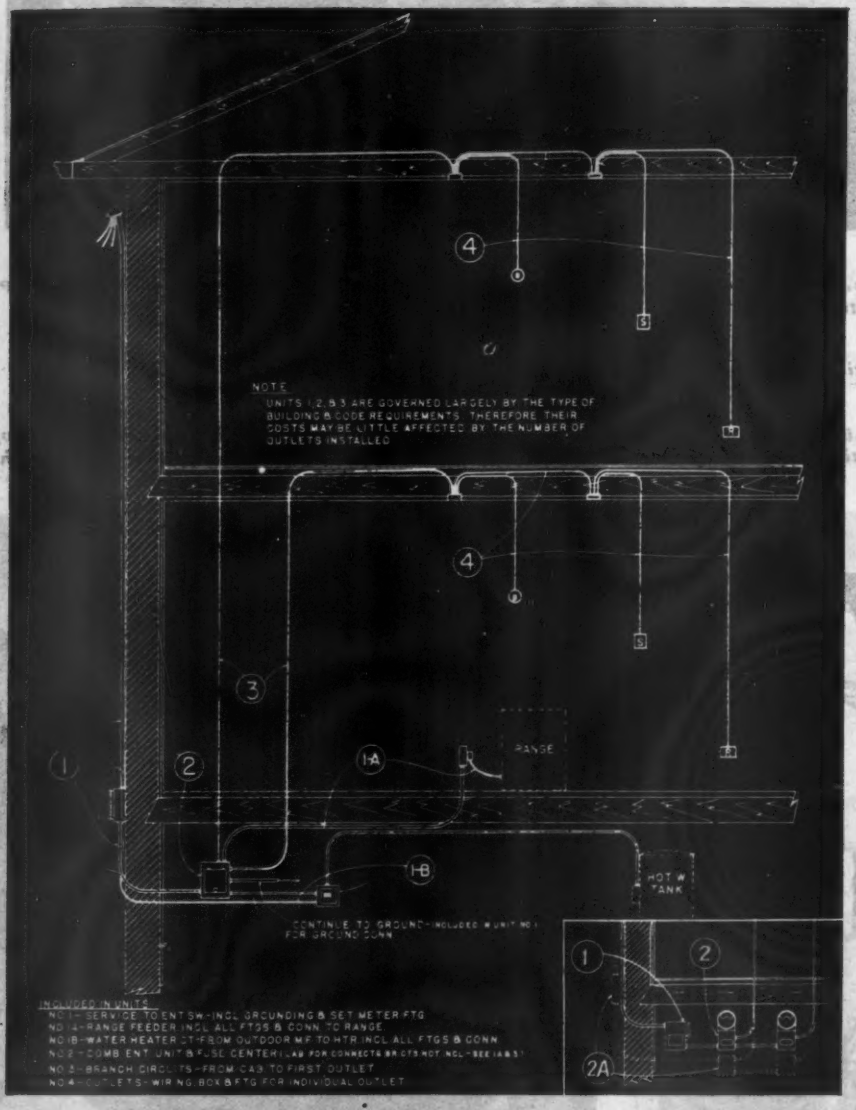

NOTE
UNITS 1, 2, & 3 ARE GOVERNED LARGELY BY THE TYPE OF BUILDING & CODE REQUIREMENTS. THEREFORE THEIR COSTS MAY BE LITTLE AFFECTED BY THE NUMBER OF OUTLETS INSTALLED
RANGE
HOT W TANK
INCLUDED IN UNITS
NO 1 - SERVICE TO ENT SW - INCL GROUNDING & SET METER FTG
NO 1A - RANGE FEEDER INCL ALL FTGS & CONN TO RANGE
NO 1B - WATER HEATER CT - FROM OUTDOOR MF TO HTR INCL ALL FTGS & CONN
NO 2 - COMB ENT UNIT & FUSE CENTER INCL AB FOR CONNECTS BR CTS NOT INCL - SEE 1A & 3
NO 3 - BRANCH CIRCUITS - FROM CAB TO FIRST OUTLET
NO 4 - OUTLETS - WIRING BOX & FTG FOR INDIVIDUAL OUTLET

Fig. 1—Single-family residence layout showing segregation of wiring into units for cost determination under the "4-Unit System" of estimating. Metering for multiple-family dwelling is shown inset.

A GREAT residential boom is in the offing. We are all aware of that. To the electrical contractor the important thing is—will it bring a large volume of electrical work? A glance at past records will throw some light on the answer. During normal building periods in the past, residential construction has provided 55 percent of the electrical installation work. This rate may be anticipated for the next building cycle. Will this building boom mean prosperity for the electrical contractors, or will it not?

Building booms have come and gone before. In their wake we have found numerous "would-be electrical contractors" strewn along the road to the poorhouse. Some of them like to reminisce "I was once a big electrical contractor." Actually, they never were. They were just little contractors getting rid of their money in a hurry. Business volume alone does not determine the "bigness" of a contractor. Organization, accurate cost methods and a reasonable return for services rendered play a vital part in the success of contracting activities.

Contractors competing for the new residential electrical installation work can be grouped into three broad categories:

1. Those established contractors who have confined their activities to residential work.
2. Those established contractors who have been largely engaged in other types of electrical work.
3. New contractors who have never operated any kind of electrical construction business.

We are especially interested in the first group. They have been doing a good job maintaining residential wiring as a healthy business. They have stayed in their own field and not interfered with other contractors by trying to take work for which they were neither organized nor equipped to handle. With a trained organization, years of experience and skilled mechanics as a nucleus, they will have a decided advantage over contractors new in the residential wiring field when building begins on a larger scale. The second group, if they decide to do some of this work, can make it profitable by

L WIRING

adapting their "big job" estimating and organizational techniques to this small work. The third group, of course, has everything to learn about the electrical construction business.

Job Selection and Estimating

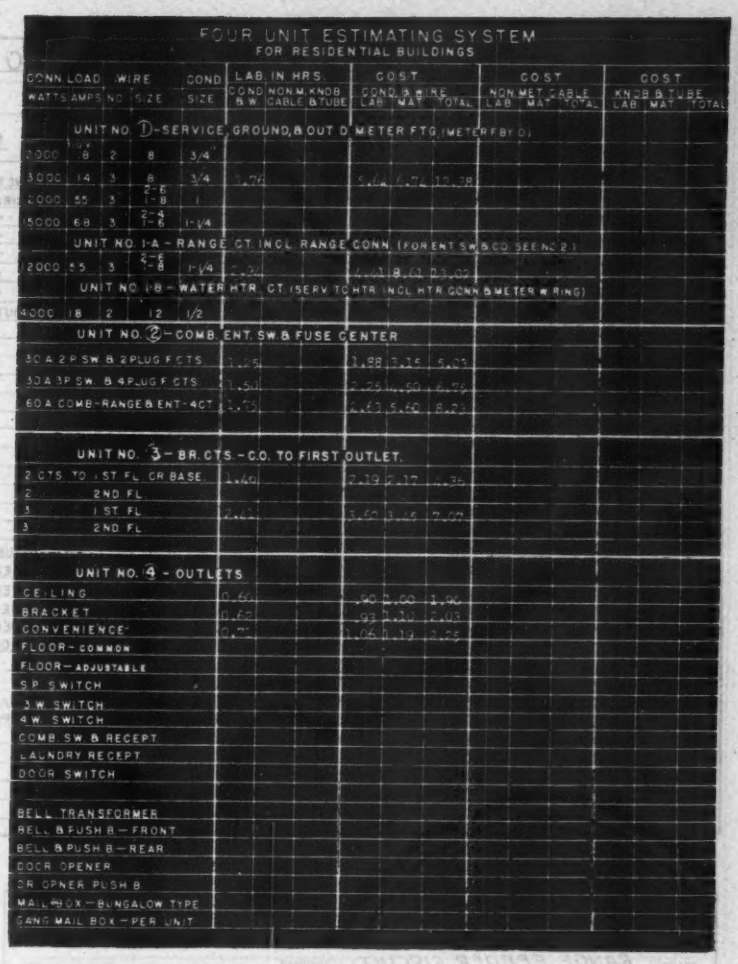
Whether these or any other contractors make any money in this field depends largely on four important phases of the business:

1. Proper selection of jobs.
2. Ability to economically handle the volume of work secured.
3. Reliable accounting methods to reflect true operating costs.
4. Restricting expansion within proper limits.

Residential work is generally considered, in the trade, the simplest form of electrical construction. Any well trained estimator will refute this general contention. Its apparent simplicity, to those acquainted with it, comes from a long familiarity with every detail of the work and the use of competent mechanics to make the installation. Good mechanics, however, cannot overcome the handicaps of laxity in estimating generally caused by a contractor's: (1) Inability to adequately analyze work requirements and reconcile cost differences between various jobs; (2) tendency to become a slave of habit and indulge in mental lassitude.

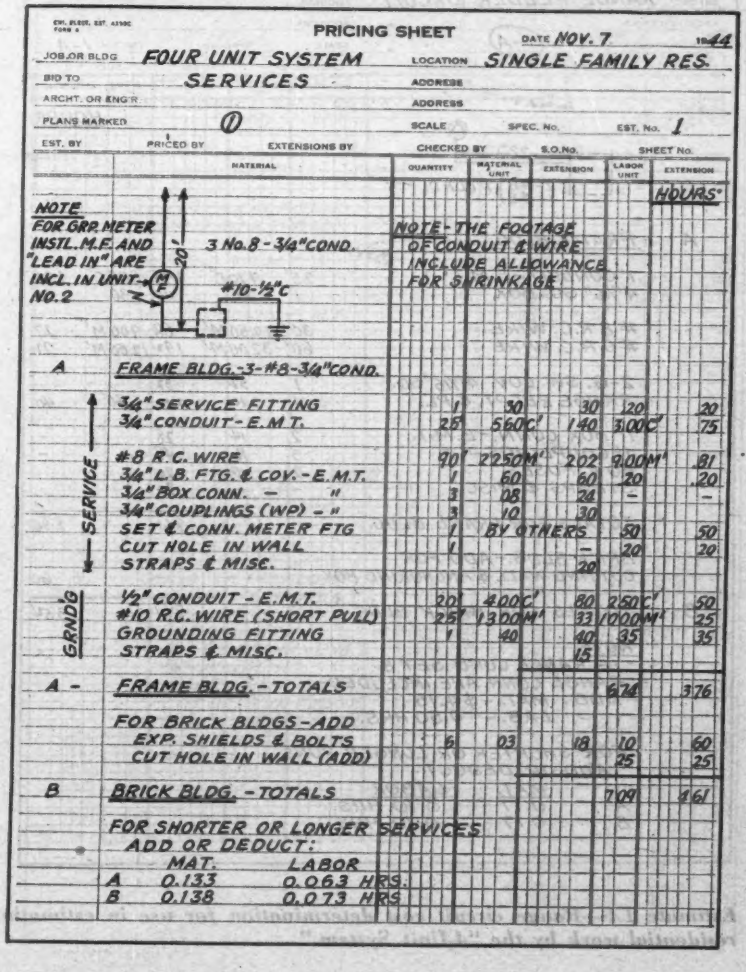
The contractor must have the faculty for careful appraisal of the work; the technical and clerical organization to do the job and keep accurate costs; and an intelligent restraint to over-expansion.

Proper job selection—an item of major importance—depends on proper appraisal which, in turn, necessitates



FOUR UNIT ESTIMATING SYSTEM
FOR RESIDENTIAL BUILDINGS

CONN. LOAD WATTS	AMPS	WIRE NO.	WIRE SIZE	COND SIZE	LAB. IN HRS. COND. & W.	LAB. IN HRS. NON-M. KNOB & CABLE & TUBE	COST COND. & WIRE LAB.	COST COND. & WIRE MAT.	COST COND. & WIRE TOTAL	COST NON-MET. CABLE LAB.	COST NON-MET. CABLE MAT.	COST NON-MET. CABLE TOTAL	COST KNOB & TUBE LAB.	COST KNOB & TUBE MAT.	COST KNOB & TUBE TOTAL
UNIT NO. 1 - SERVICE, GROUND, & OUT'D METER FTG. (METER FTG BY O)															
2000	18	2	8	3/4											
3000	14	3	8	3/4											
2000	55	3	2-6	1											
5000	68	3	1-8	1-1/4											
			2-4												
			1-6												
UNIT NO. 1-A - RANGE CT. INCL. RANGE CONN. (FOR ENT. SW. & CO. SEE NO. 2)															
2000	55	3	2-6	F1/4											
			1-8												
UNIT NO. 1-B - WATER HTR. CT. (SERV. TO HTR. INCL. HTR. CONN. & METER W. RING)															
4000	18	2	12	1/2											
UNIT NO. 2 - COMB. ENT. SW. & FUSE CENTER															
30 A 2 P. SW. & 2 PLUG F. CTS.															
30 A 3 P. SW. & 4 P. PLUG F. CTS.															
60 A COMB-RANGE & ENT-4 CT															
UNIT NO. 3 - BR. CTS. - C.O. TO FIRST OUTLET.															
2 CTS. TO 1 ST FL. OR BASE															
2 2ND FL.															
3 1 ST FL.															
3 2ND FL.															
UNIT NO. 4 - OUTLETS															
CEILING															
BRACKET															
CONVENIENCE															
FLOOR - COMMON															
FLOOR - ADJUSTABLE															
S.P. SWITCH															
3 W. SWITCH															
4 W. SWITCH															
COMB. SW. & RECEPT.															
LAUNDRY RECEPT.															
DOOR SWITCH															
BELL TRANSFORMER															
BELL & PUSH B. - FRONT															
BELL & PUSH B. - REAR															
DOOR OPENER															
DR. OPNER PUSH B.															
MAIL BOX - BUNGALOW TYPE															
GANG MAIL BOX - PER UNIT															



PRICING SHEET — DATE NOV. 7 19 44

JOB OR BLDG. FOUR UNIT SYSTEM — LOCATION SINGLE FAMILY RES.
BID TO SERVICES — ADDRESS
ARCHT. OR ENG'R — ADDRESS
PLANS MARKED 0 — SCALE — SPEC. No. — EST. No. 1
EST. BY — PRICED BY — EXTENSIONS BY — CHECKED BY — S.O. No. — SHEET No.

	MATERIAL	QUANTITY	MATERIAL UNIT	MATERIAL EXTENSION	LABOR UNIT	LABOR EXTENSION
						HOURS
	NOTE FOR GRP. METER INSTL. M.E. AND "LEAD IN" ARE INCL. IN UNIT-NO. 2 — 3 No. 8 - 3/4" COND. 20' — #10-1/2"C		NOTE - THE FOOTAGE OF CONDUIT & WIRE INCLUDE ALLOWANCE FOR SHRINKAGE			
A	FRAME BLDG. - 3 - #8 - 3/4" COND.					
SERVICE	3/4" SERVICE FITTING	1	30	30	120	20
SERVICE	3/4" CONDUIT - E.M.T.	25'	560C'	140	3.00C'	75
SERVICE	#8 R.C. WIRE	70'	2250M'	202	9.00M'	81
SERVICE	3/4" L.B. FTG. & COV. - E.M.T.	1	60	60	20	20
SERVICE	3/4" BOX CONN. - "	3	08	24	-	-
SERVICE	3/4" COUPLINGS (WP) - "	3	10	30		
SERVICE	SET & CONN. METER FTG	1	BY OTHERS		50	50
SERVICE	CUT HOLE IN WALL	1		-	20	20
SERVICE	STRAPS & MISC.			20		
GRND'G	1/2" CONDUIT - E.M.T.	20'	4.00C'	80	2.50C'	50
GRND'G	#10 R.C. WIRE (SHORT PULL)	25'	13.00M'	33	1.00M'	25
GRND'G	GROUNDING FITTING	1	40	40	35	35
GRND'G	STRAPS & MISC.			15		
A -	FRAME BLDG. - TOTALS				6.74	3.76
	FOR BRICK BLDGS - ADD					
	EXP. SHIELDS & BOLTS	6	03	18	10	60
	CUT HOLE IN WALL (ADD)				25	25
B	BRICK BLDG. - TOTALS				7.09	4.61
	FOR SHORTER OR LONGER SERVICES ADD OR DEDUCT:					
		MAT.	LABOR			
	A	0.133	0.063 HRS.			
	B	0.138	0.073 HRS.			

Fig. 2—Master cost sheet, for estimating single family residential wiring. Sheet accommodates units for various sized services, load centers and different types of wiring. Cost figures, derived from separate estimates for each category of the "4-Unit System," are used in the final wiring estimate. (Top Right)

Estimate 1—Service basic cost method for the single family residence. Similar estimates must be made for larger services and those for multiple-family dwellings.

JOB COSTS

SERVICE AND SUB-SERVICE
FOR
OUTDOOR METERING—BASED ON 30 FT. MAIN SERVICE

LOAD		WIRE		COND.	LAB. IN HRS.			COSTS								
WATTS	AMPS	NO.	SIZE	SIZE	COND. & W.	NONM. CABLE	Adj.	COND. & WIRE LAB.	COND. & WIRE MAT.	COND. & WIRE TOTAL	NON MET. CABLE LAB.	NON MET. CABLE MAT.	NON MET. CABLE TOTAL	LAB.	MAT.	TOTAL
	ALL EXTERIOR NO-FUSE SERVICE															
2000	8	2	8	3/4"		3.2										
3000	14	3	8	3/4"		3.5										
3000-11000	14-30	3	8-2 / 1-8	1		4.3										
11000-15000	30-70	3	4	1 1/4"		5.5										
15000-19000	70-90	3	2	1 1/2"		10.6										
19000-22000	80-100	3	1	1 1/2"		11.7										
22000-27500	100-125	3	0	2"		15.8										
27500-33000	125-150	3	00	2"		16.9										
SERVICE WITH SW. & SUB FUSES (IN SLOW BURNING TYPE)																
22000-27500	100-125	3	0	2"		22.4										
27500-33000	125-150	3	00	2"		25.3										
33000-38500	150-175	3	000	2"		26.5										
38500-49500	175-225	3	0000	2 1/2"		41.2										
SUB SERVICES																
ALLOW FOR EA. METER SERVED --- (Sl. ins.)						2.15										
RANGE CIRCUIT																
8000-12000	22-30	3	6	1"		6										
HOT WATER HEATER CIRCUIT																
1000-42000	4.5-20	2	12	1/2"		4.5										

NOTES:
1—EXTERIOR SERVICES WITH NO. 1 TO NO. 00 CABLE, INCLUDE TERMINAL CAP FOR REDUCING SIZE OF WIRE RUN TO METER FITTINGS
2—SERVICES WITH SWITCH & SUB SERVICE FUSES, INCLUDE LEAD OUT WIRE & COND. TO METER FTGS. AT SERVICE LOCATION.
3—ALL SERVICES INCLUDE GROUNDING.
4—SUB SERVICE UNITS ARE TO BE ADDED FOR GROUPS OF METERS LOCATED REMOTE FROM MAIN SERVICE ENTRANCE.
5—THIN WALL CONDUIT FIGURED THROUGHOUT, UP TO AND INCLUDING 2"
6—METER FTG. UNIT INCLUDES TENANT SWITCH, CUT OUTS, AND CONNECTIONS BETWEEN SWITCH AND METER FITTING.
7—RANGE CIRCUIT UNIT INCLUDES "FUSE PULLER" PAR. WITH 2-30A. "PLUG FUSE DTS. ALSO RECEPT. AT RANGE.
8—HOT WATER HEATER UNIT INCLUDES SWITCH AND CONNECTIONS TO HEATER.
9—UNITS ARE FOR COMPUTATION ONLY AND ARE NOT APPLICABLE TO ANY PARTICULAR LOCALITY.
10—INSURANCE, INSPECTION, AND CARTAGE ARE NOT INCLUDED IN THE UNITS.

Adj. - Contractor to enter his own labor units in this column - adjusted to conform to job conditions in his locality.

OUTLETS & FITTINGS

ITEMS	LAB. IN HRS. COND. & W.	LAB. IN HRS. ARM. CABLE	LAB. IN HRS. NONM. CABLE	COSTS CONDUIT & WIRE LAB.	CONDUIT & WIRE MAT.	CONDUIT & WIRE TOTAL	ARM. CABLE LAB.	ARM. CABLE MAT.	ARM. CABLE TOTAL	NONMET. CABLE LAB.	NONMET. CABLE MAT.	NONMET. CABLE TOTAL
METER FTGS. SW. & CO.	2.5											
CIRCUITS — 2 TO 1 22 FL.	1.06											
" " 2 " 2 2D "	1.53											
" " 2 " 3 2D "	2.0											
" " 3 " 1 22 "	1.94											
" " 3 " 2 2D "	2.7											
" " 3 " 3 2D "	3.4											
OUTLETS — CEILING	0.5											
" " BRACKET	0.5											
" " CONVENIENCE	0.65											
" " FLOOR-COMMON	1.0											
" " " " ADJUST.	1.18											
" " S.P. SWITCH	0.65											
" " 3 W. " "	0.76											
" " 4 W. " "	1.0											
" " ELECTROL. SW.	1.0											
" " COMB. SW. & REC.	0.72											
" " DOOR SW.	1.15											
" " LAUNDRY REC.	0.56											
PUBLIC LTG. OUTLETS	0.74											
BELL TRANSFORMER	0.56											
TELEPHONE—PUBLIC	0.47											
BELL—FRONT	0.93											
BELL & PUSH—REAR	1.03											
DOOR OPENER	1.44											
" " PUSH	0.65											
MAIL BOX - PER GANG	0.5											
SPEAKING TUBE	1.06											

Fig. 3—Expanded master cost sheet for tabulating unit costs to be used in estimating wiring for multiple-family dwellings where multiple-metering, sub-feeders, and other expanded electrical facilities are encountered.

PRICING SHEET DATE NOV. 7 19 44

JOB OR BLDG. FOUR UNIT SYSTEM LOCATION SINGLE FAMILY RES.

BID TO RANGE FEEDER CIRCUIT ADDRESS

ARCHT. OR ENG'R. ADDRESS

PLANS MARKED (1-A) SCALE SPEC. No. EST. No. 1-A

EST. BY PRICED BY EXTENSIONS BY CHECKED BY S.O. No. SHEET No.

	MATERIAL	QUANTITY	MATERIAL UNIT	MATERIAL EXTENSION	LABOR UNIT	LABOR EXTENSION
						HOURS
	22" 2-#6 1-#8 } 1" COND.					
A	FRAME BLDG.					
	1" CONDUIT - E.M.T.	25'	7.70 C'	1.93	5.00 C'	1.25
	4 11/16" SQ. BOX	1	.40	.40	.30	.30
	# 8 R.C. WIRE	30'	22.50 M'	.68	9.00 M'	.27
	# 6 R.C. WIRE	60'	32.00 M'	1.93	12.00 M'	.72
	2-G. SW. COV. 4 11/16" SQ.	1	.33	.33		
	RANGE RECPT. & PL.	1	2.10	2.10	.40	.40
	1" BOX CONN. - E.M.T.	2	.14	.28		
	1" COUPLINGS - "	3	.16	.48		
	60 A. FUSES	2	.10	.20		
	STRAPS & MISC.			.30		
	TOTALS FOR FRAME BLDG.			8.61		2.94
	BRICK BLDG. - ADD FOR CUTTING WALL & ANCHORING BOX					.60
B	TOTALS FOR BRICK BLDG.			8.61		3.54

NOTE:
IF RANGE CORD SET & RANGE CONN. ARE INCLUDED - ADD: MAT. - $4.15
LAB. - 0.50 HRS.

FOR SHORTER OR LONGER RUNS ADD OR DEDUCT

	MAT.	LABOR
A	0.17	0.10 HRS.
B	0.17	0.10 HRS.

Estimate 1A—Range circuit cost determination for use in estimating residential work by the "4-Unit System."

accurate estimating. Accuracy in estimating cannot be accomplished by what is commonly known as the "cost per outlet" method. Good contractors know this, yet many of them still cling to this faulty system.

Normally, this method implies the application of a common cost unit to all types of outlets, *such unit to be ample to cover a pro rata share of the cost of service, grounding, metering facilities, load center and miscellaneous items.* For a certain class of residential wiring, such units may be used—provided the units are properly prepared and applied only to that phase of the wiring for which they were intended. *When used for over-all estimating of residential wiring, they do not reflect accurate costs.*

Like all types of electrical construction work, residential wiring must be estimated on a sound step-by-step method utilizing separate units to cover logically segregated portions of the wiring system. The value of employing a method—such as the "4-Unit System" described below—that establishes such accurate segregated costs is emphasized by the accompanying charts and sample estimates.

Estimate 2—Load center installation unit cost determined at right comprises the second unit of the "4-Unit System" of estimating residential wiring.

The "Collins 4-Unit System" provides one method of determining accurate unit costs of this type. It includes separate units for each type of outlet, home runs (circuits from load center to first outlet), load centers, and service. It is designed for estimating moderate priced residences ranging from $5,000 to approximately $15,000 in cost. High priced custom built homes have to be estimated in the conventional manner for special electrical construction work. In such homes, better materials are used, wiring is more liberal, building progress is slower, tolerances for locating outlets is less, and numerous other features are encountered which produce costs greater than those for smaller homes.

The 4-Unit System

The "4-Unit System" is not new. It was created back in 1914 by J. Walter Collins, secretary of the Electrical Contractors Association of City of Chicago. At that time he was associated with the Hub Electric Company of Chicago—a firm whose annual residential wiring totalled $400,000.

While other contractors were floundering around with the old "so much per outlet" method of estimating residential wiring, this firm was forging ahead with business secured by the "4-Unit System."

The Four Units, as illustrated by Fig. 1 for residential buildings are:

A—Single Family Dwellings

1. Service to load center, including grounding.
2. Load center.
3. Circuits to first outlet (home runs).
4. The outlets (separate units for *each type* of outlet).

B—Multiple Family Dwellings

1. Service to meter fitting, main switch (if any) and grounding.
2. Load centers and metering facilities.
3. Circuits to first outlet (home runs).
4. The outlets (separate units for *each type* of outlet).

Estimate 3—Home runs or branch circuits from the load center to the first outlet comprise the third unit cost of the "4-Unit System."

PRICING SHEET — DATE Nov. 7 1944

JOB OR BLDG. FOUR UNIT SYSTEM — LOCATION ONE FAMILY RESIDENCE
BID TO COMB. SERVICE SWITCH AND — ADDRESS
ARCHT. OR ENG'R. FUSE CENTER — ADDRESS
PLANS MARKED (2) — SCALE — SPEC. No. — EST. No. 2
EST. BY — PRICED BY — EXTENSIONS BY — CHECKED BY — S.O.No. — SHEET No.

	MATERIAL	QUANTITY	MATERIAL UNIT	EXTENSION	LABOR UNIT	EXTENSION
						HOURS
	MOUNTING BOARD COMB. METER-SERVICE SWITCH & FUSE CENTER					
A	FRAME BLDG.-2 CKT. UNIT					
	30A. 2P. SW., 2 BR. CKTS. (COMB.)	1	2.75	2.75	COMM. M ONLY	1.—
	MOUNT BOARD	1	.30	.30		.25
	FUSE (MAIN) & MISC.	1	—	.10		—
	TOTAL FOR FRAME BLDG.			3.15		1.25
A-1	TOTAL FOR BRICK BLDG. (ADD FOR EXP. SHIELDS)			3.27		1.60
B	FRAME BLDG.-4 CKT. UNIT					
	30A. 3P. SW., 4 BR. CKTS. (COMB.)	1	4.00	4.00		1.75
	MOUNT BOARD	1	.35	.35		.25
	FUSES (2 MAIN) & MISC.	2	1.15	.15		—
	TOTAL - FRAME BLDG.			4.50		1.50
B-1	TOTAL - BRICK BLDG. (ADD FOR EXP. SHIELDS)			4.62		1.85
C	FRAME BLDG.-RANGE-4 CKT. UNIT					
	COMB. UNIT-60A. M., 60A. RANGE					
	CKT. & 4 BR. CKTS.	1	4.75	4.75	COMM. MAIN ONLY	1.50
	MOUNT BOARD	1	.50	.50		.25
	FUSES (MAINS ONLY) —	2	.10	.20		—
	MISC.			.15		—
	TOTAL - FRAME BLDG.			5.60		1.75
C-1	TOTAL - BRICK BLDG. (ADD FOR EXP. SHIELDS)			5.72		2.10

PRICING SHEET — DATE NOV. 7 1944

JOB OR BLDG. FOUR UNIT SYSTEM — LOCATION RESIDENTIAL BLDG.
BID TO BRANCH CIRCUITS — ADDRESS
ARCHT. OR ENG'R. (CABINET TO 1ST OUTLET) — ADDRESS
PLANS MARKED (3) — SCALE — SPEC. No. — EST. No. 3
EST. BY — PRICED BY — EXTENSIONS BY — CHECKED BY — S.O.No. — SHEET No.

	MATERIAL	QUANTITY	MATERIAL UNIT	EXTENSION	LABOR UNIT	EXTENSION
						HOURS
A	2 CKTS TO 1ST FLOOR (2-#12 and 2-#14)					
	3/4" COND. - E.M.T.	20'	5.60 C	1.12	3.00 C	.60
	#14 R.C. WIRE	45'	6.50 M	.29	5.00 M	.22
	#12 R.C. WIRE	45'	8.80 M	.40	6.00 M	.27
	3/4" BOX CONN. - E.M.T.	1	.08	.08		—
	3/4" COUPLING - "	1	.10	.10		—
	CONNECT CKTS. TO PANEL	2	—	—	.15	.30
	FUSES	2	.03	.06	—	—
	CUT HOLE IN FLOOR	1	—	—	.07	.07
	STRAPS & MISC.		—	.12		
	TOTAL UNIT/FT. COND. & WIRE MAT. - 0.086 LAB. - 0.05 HRS.			2.17		1.46
B	3 CKTS. TO 1ST FLOOR					
	2 CKTS. - SEE ABOVE			2.17		1.46
	1/2" COND. - E.M.T.	20'	4.00 C	.80	2.50 C	.50
	#14 R.C. WIRE	45'	6.50 M	.29	5.00 M	.23
	1/2" BOX CONN. - E.M.T.	1	.06	.06		—
	1/2" COUPLING	1	.05	.05		—
	CONNECT CKT. TO PANEL	1	—	—	.15	.15
	CUT HOLE IN FLOOR	1	—	—	.07	.07
	FUSES, STRAPS & MISC.			.08		—
	TOTALS			3.45		2.41

PRICING SHEET — DATE NOV. 7 — 19 44

JOB OR BLDG. FOUR UNIT SYSTEM — LOCATION RESIDENTIAL BLDG.
BID TO OUTLETS — ADDRESS
ARCHT. OR ENG'R. — ADDRESS
PLANS MARKED ④ — SCALE — SPEC. No. — EST. No. 4
EST. BY — PRICED BY — EXTENSIONS BY — CHECKED BY — S.O.No. — SHEET No.

	MATERIAL	QUANTITY	MATERIAL UNIT	MATERIAL EXTENSION	LABOR UNIT	LABOR EXTENSION
A	CEILING OUTLETS					HOURS
	BOX & HANGER	1	15	15	18	18
	½" COND. - E.M.T.	115'	400C	46	2.50C	29
	#14 R.C. WIRE	261'	6.50M	17	5.00M	13
	½" BOX CONN. - E.M.T.	2	06	12		—
	½" COUPLINGS - "	1	05	05		—
	STRAPS & MISC.		05	05		—
	TOTALS			100		60
B	BRACKET OUTLETS					
	4" SQ. BOX & BR. COV.	1	14	14	18	18
	BAR HGR. & STUD	1	08	08		—
	½" COND. - E.M.T.	12'	4.00C	48	2.50C	30
	#14 R.C. WIRE	28'	6.50M	18	5.00M	14
	½" BOX CONN. - E.M.T.	2	06	12		—
	½" COUPLING - "	1	05	05		—
	STRAPS & MISC.			05		—
	TOTALS			110		62
C	CONVENIENCE OUTLETS					
	4" SQ. BOX & SW. COV.	1	14	14	18	18
	BAR HANGER	1	05	05	—	—
	½" COND. - E.M.T.	115'	4.00C	44	2.50C	29
	#14 R.C. WIRE	261'	6.50M	17	5.00M	13
	½" BOX CONN. - E.M.T.	2	06	12		—
	½" COUPLING	1	05	05		—
	STRAPS & MISC.		—	05		—
	RECEPTACLE & PLATE	1	15	15	12	12
	TOTALS			119		72
					USE →	70

Estimate 4—Outlets are the fourth unit cost of the "4-Unit System." A separate cost is made for each type of outlet encountered in residential wiring. Note difference in cost between different outlets. (Above)

Now that we have discussed the fundamental considerations of residential electrical estimating, let's investigate the details of unit cost determination. No units can be established for quickly and accurately estimating electrical work without expending some effort and expense. Residential wiring offers no exception.

The cost items to be used as *units* in the "4-Unit System" are established by preparing estimates similar to those illustrated (for single family residences). Estimate 1 covers services; Estimate 1-A, range circuits; Estimate 2, load centers; Estimate 3, branch circuit home runs; Estimate 4, various types of outlets. Similar cost estimates for units found in multiple-family residences can be made.

After checking a few installation costs, the contractor may find that the original estimates have to be revised. There is no reason why material costs cannot be estimated accurately. Labor costs may vary and necessary adjustments can be made accordingly.

Once the basic unit costs, for each of the 4-Unit categories, have been determined they can be tabulated on a Master Cost Sheet illustrated in Fig. 2 (single-family residences). Costs can be entered for various sized services and load centers and for various types of wiring systems. Fig. 3 illustrates a similar Master Cost Sheet expanded to cover multiple-family dwellings where sub-metering, sub-feeders and other conditions are normally encountered.

Using the Master Cost Sheet as a reference, the contractor can quickly prepare an accurate estimate of the wiring cost for any type of residence. Estimate 5 shows the basic cost for wiring two similar homes—one with 37 outlets and one with 50 outlets. This is only a material and labor cost. To establish a selling price (quotation to the customer) *charges must be added* for inspection, insurance, cartage, operating costs and return.

[Continued on page 119]

Estimate 5—Complete cost for a residential wiring job embodying the individual unit costs determined under the "4-Unit System." Unit costs entered here are taken from Master Cost Sheet tabulation of all costs determined in the unit estimates. Note variance in average cost per outlet between the two estimates shown.

PRICING SHEET — DATE NOV. 7 — 19 44

JOB OR BLDG. FOUR UNIT SYSTEM — LOCATION COND. (E.M.T.) & WIRE
BID TO COST ESTIMATE FOR — ADDRESS LABOR - $1.50 PER HOUR
ARCHT. OR ENG'R. A RESIDENCE — ADDRESS
PLANS MARKED — SCALE — SPEC. No. — EST. No. 5
EST. BY — PRICED BY — EXTENSIONS BY — CHECKED BY — S.O.No. — SHEET No.

ESTIMATING UNIT	MATERIAL	QUANTITY	MATERIAL UNIT COST	TOTAL COST	LABOR UNIT	EXTENSION
	- CASE I - 37 OUTLETS -					
①	SERVICE - 3 - #8W - ¾"C (INCL GRD)	1		$ 12.40		
②	ENT. SW. & FUSE CEN. (30A 3P SW., 4 CKTS)	1		6.75		
③	BR. CKTS - 2 CKTS. TO 1ST FL.	1		4.36		
④	CEILING OUTLETS	14	1.90	26.60		
	S.P. SWITCH OUTLETS	7	2.28	15.96		
	3-WAY " "	2	2.78	5.56		
	CONVENIENCE "	14	2.25	31.50		
	TOTAL (MAT. & LABOR			$ 103.13		
	AVG. PER OUT. - $2.79					
	- CASE II - 50 OUTLETS -					
①	SERVICE - 3 - #8W - ¾"C (INCL GRD)	1		$ 12.40		
②	ENT. SW. & FUSE CEN. (30A 3P SW., 4 CKTS)	1		6.75		
③	BR. CKTS - 2 CKTS. TO 1ST FL.	1		4.36		
④	CEILING OUTLETS	20	1.90	38.00		
	BRACKET OUTLETS	3	2.03	6.06		
	S.P. SWITCH "	8	2.28	18.24		
	3-WAY " "	2	2.78	5.56		
	CONVENIENCE "	18	2.25	40.50		
	TOTAL (MAT. & LABOR)			129.87		
	AVG. PER OUT. - $2.60					
	TOTAL COST - 50 OUTLETS -			$ 129.87		
	COST OF FIRST 37 OUT. -			103.13		
	COST OF ADD'L 13 OUT. -			26.74		
	AVG. COST PER ADD. OUT. -			2.06		

NOTE:
IF 33 1/3 PERCENT WAS ADDED TO THE $2.60 TOTAL COST (CASE II) TO ESTABLISH A SELLING PRICE THE RESULT WOULD BE $3.72.
THE ADDITIONAL OUTLETS IN CASE II COULD HAVE A 30 PERCENT MARK-UP AND A SELLING PRICE OF $2.89.

LIGHTING TECHNIQUES FOR RESTAURANTS

New lighting techniques are available for lighting restaurants. Modern practice is to combine light with architecture and decorations. Modernization of over 150,000 existing restaurants and construction of new restaurants offers an immediate lighting market.

By Berlon C. Cooper

LIGHTING for public dining areas can be even more varied than the number of ways eggs can be prepared and served. This is because there are so many varieties or types of eating places. Public dining areas include cafes, night clubs, restaurants, cafeterias, coffee shops, sandwich shops, dining rooms, supper rooms and banquet rooms.

Designs for public dining areas cover a wide variety of functional layouts and decorative treatments. Some feature counter service. Some feature table service. Some use gleaming white porcelain, while others use colors on wood, plastics, or special composition counter and table tops. Still others feature linen for table service.

Decorative treatment of restaurants ranges from very plain to highly ornate. Many follow modern design, while some adhere to traditional period decorations. Decorations may be confined to paint on plain ceilings and side walls, or may include pictures, architectural treatment, murals, tapestries, lighted configurated glass panels, or a number of other decorative devices. Existing restaurants on the average are poorly lighted. These offer an immediate relighting market as fast as materials and labor become available.

Color quality of illumination is controlled at Blue Bird Cafeteria, Kansas City, by combining 200 watt recessed incandescent units with two-lamp 40 watt fluorescent decorative ceiling mounted units. Intensity is over 25 footcandles.

Cheerful atmosphere is created in Savarin Coffee Shop, Lexington Avenue and 50th Street, New York City, by use of direct and indirect incandescent lighting. Raised panel in center of ceiling is indirect lighted by large pedestal in center of room (not shown in photo). Flush down lights and surface exposed luminous glass units provide additional light and decorative touch near walls.

Good lighting pays dividends to the restaurant owner. An attractive and well lighted entrance will aid in competing with other restaurants and main street attractions. A bright and cheerful interior will help in making satisfied customers.

Fundamentals of good lighting practice should be followed in lighting public dining spaces, the same as in other types of interiors. All light sources should be shielded to prevent glare. Sharp contrasts in brightness, as well as overly bright surfaces, should be avoided. Light sources should be carefully selected to provide a proper color quality for each lighting application. An adequate level of illumination intensity should be provided, which will enable guests to read the menu, see the food and other guests with ease. Such an intensity will also encourage cleanliness, and instill a feeling of proper sanitation. Every effort should be made to create a comfortable, cheerful atmosphere. Light for utilitarian use should be undistorted in color. Decorative lighting may be used to good advantage to supplement, or form a part of, the decorative treatment.

Many new restaurants will be built, now that WPB construction controls are being relaxed. It is in these new projects that the greatest use can be made of the many new lighting techniques. Provision can be made in preliminary design stages for recessed and built-in equipment. Full use can be made of indirect coves, reverse coves, recessed coffers and troffer units, illuminated glass panels, lighted wall niches, and other similar architectural and decorative elements. Costs for such treatments can be kept at a minimum on new projects.

Application of architectural lighting techniques to remodeling and redecorating jobs will often be more difficult than on new projects. Some lighting techniques may require major structural changes on old jobs. It is desirable, therefore, to have a broad knowledge of the many techniques which may be followed to achieve an appropriate specific lighting result in relighting existing restaurants.

Restaurants are here divided into eight separate classifications, to simplify discussion of various lighting techniques applicable to each.

1. *Cafeterias with plain decorative treatment.* Typical of these are cafeterias in schools, industrial plants and office buildings, and some public cafeterias. A minimum intensity of ten to twenty footcandles general illumination should be provided for these cafeterias. Individual lighting units, using incandescent or fluorescent lamps, and located on symmetrically spaced outlets, provide satisfactory lighting results efficiently. Recessing the units flush in the ceiling where ceiling heights do not exceed twelve feet adds to the appearance of the installation. Food serving counters should be highlighted with reflector type equipment located over the counters.

2. *Cafeterias with ornamental decorative treatment.* This class of cafeteria is usually for public patronage as differentiated from employee patronage. Decorative treatment is used to create a more refined and cheerful atmosphere. Cafeterias usually involve large areas, designed to serve a large number of customers. Large decorative type luminaires may often be used to produce the desired lighting result. Indirect lighting from such luminaires creates a very pleasing effect. Urns on walls or on columns, as well as cove lighting can often be used, depending upon structural arrangement. Silver and glassware can be made to sparkle by many types of properly shielded direct light sources installed in the luminaires or in the ceiling between luminaires. Reflectors concealed in the ceiling over food counters can be used to highlight this area, which will aid in the selection of the meal.

3. *Sandwich and Fountain Shops.* Such shops are usually small. Counter

FIG. 3. Indirect cove lighting from walls and columns retains dignity and established decorative treatment in State Room of Miller Bros. Restaurant, Baltimore. Softly illuminated wall niches provide additional decorative effect. All state seals, in color, are highlighted above the wall coves.

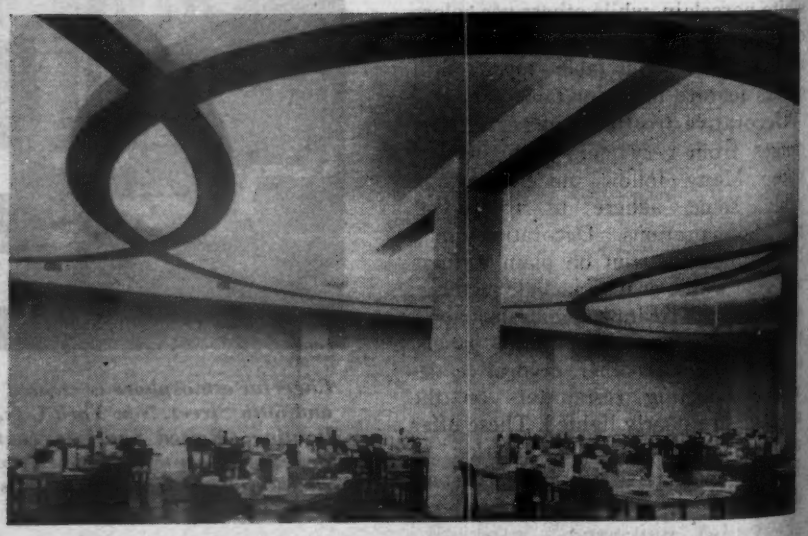


FIG. 4. Novel and decorative element in a plain room is provided by three intersecting circular troughs in employees' dining room, E. G. Budd Mfg. Co., Philadelphia, Pa. Incandescent lamps in individual reflector units provide the restful and pleasing lighting result.

service predominates. Tables or booths are often located opposite the counter. Since the food is prepared behind the counter within the customer's view, provision is often made for removing steam and hot air from this area by overhead airducts. A partition is dropped from the ceiling dividing this area from the customer area. Where such arrangement is encountered, reflector units for highlighting the counter can be located behind or in the bottom of the partition. (See Fig. 1). A number of techniques are suitable for lighting the booths or table area. Some popular treatments are: individual units, recessed, ceiling surface mounted, or suspended; continuous row equipment, ceiling surface mounted, or suspended; cove lighting; wall urn lighting; indirect lighting from reflectors located at top of booth partitions, shielded wall brackets over end of tables in booths, and many others.

4. *Restaurants and Cafes.* This classification covers a large percentage of public dining areas. They vary greatly in size, shape, functional layout, and decorative treatment. The lighting technique selected should be based on the individual layout and decorative treatment of each restaurant. The fundamental principles of good illumination discussed above, should be followed in all cases. Where the decorative treatment is simple, individual units or cove lighting provide a logical means for obtaining a desired lighting result, since lighting's function in these cases is mostly utilitarian. Where the decorative treatment is ornamental, lighting can be combined with the architecture, and with the decorative details in a multitude of ways. It is of course necessary to work out all details with the architect, designer, or decorator when light is made a part of the decorative treatment. There must be harmony between lighting fixtures and architecture in period design and in metals, finishes, and lighting effect. Where color in lighting is used as part of the decorative scheme, it must be coordinated with other color details. The lighting designer must,

(Continued on Page 200)

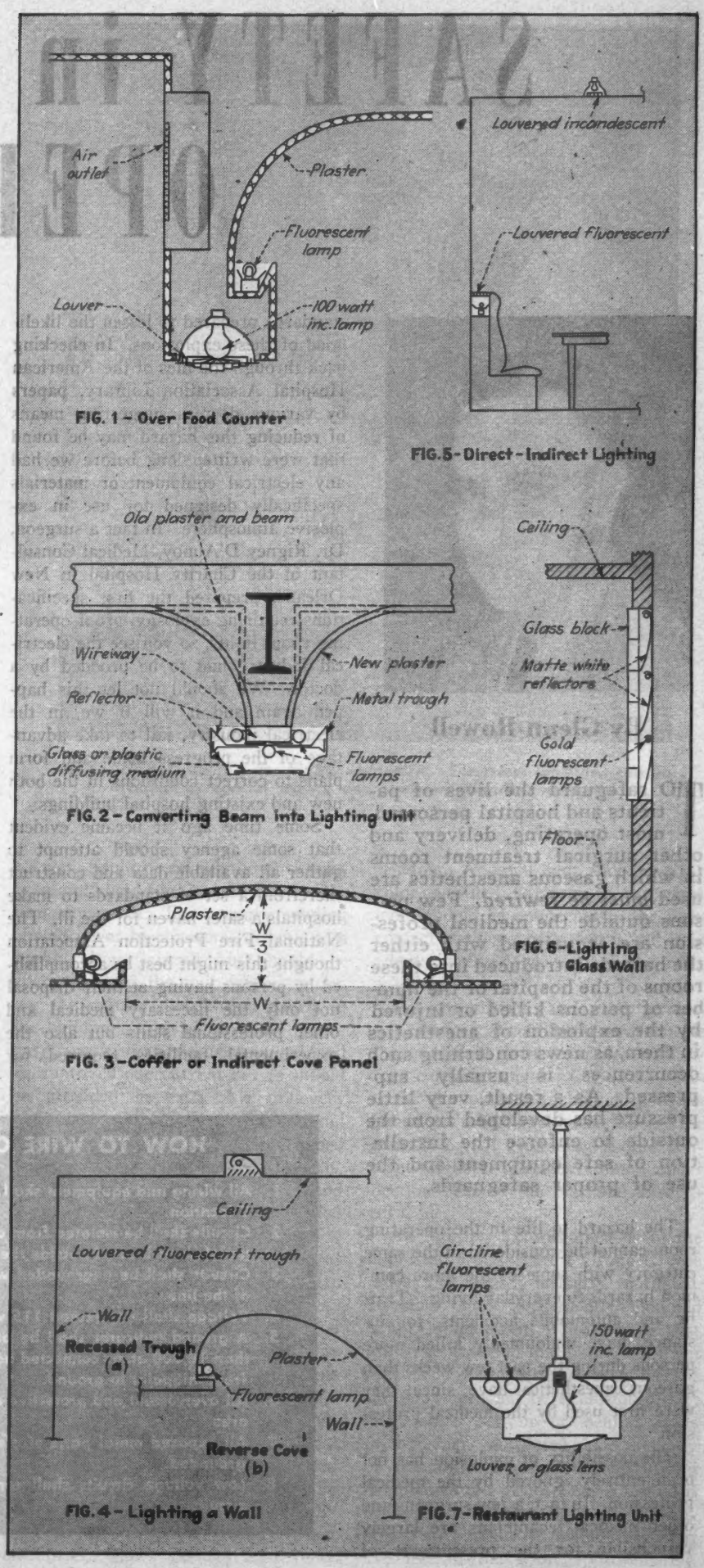


FIG. 1 – Over Food Counter

FIG. 5 – Direct – Indirect Lighting

FIG. 2 – Converting Beam into Lighting Unit

FIG. 6 – Lighting Glass Wall

FIG. 3 – Coffer or Indirect Cove Panel

FIG. 4 – Lighting a Wall

FIG. 7 – Restaurant Lighting Unit

Typical examples of modern lighting techniques applicable to restaurant lighting. Plaster coves in Figs. 1, 2, 3 and 4(b) should be finished matte white. For color effects colored lamps should be used. All direct lighting for general illumination should be with white light sources.

SAFETY in the OPERATING

By Glenn Rowell

TO safeguard the lives of patients and hospital personnel, most operating, delivery and other surgical treatment rooms in which gaseous anesthetics are used *must be rewired.* Few persons outside the medical profession are acquainted with either the hazards introduced into these rooms of the hospital or the number of persons killed or injured by the explosion of anesthetics in them, as news concerning such occurrences is usually suppressed. As a result, very little pressure has developed from the outside to enforce the installation of safe equipment and the use of proper safeguards.

The hazard to life in the operating room cannot be considered in the same category with some of the more common hazards to everyday living. Traffic and automobile accidents, for instance, have undoubtedly killed more persons during the past few weeks than gaseous anesthetics have since they were first used by the medical profession.

The possibility of explosion has not been entirely ignored by the medical profession. In fact, a few surgeons and other medical technicians are largely responsible for the present set of standards prepared to lessen the likelihood of these explosions. In checking back through the files of the American Hospital Association Library, papers by various doctors suggesting means of reducing this hazard may be found that were written long before we had any electrical equipment or materials specifically designed for use in explosive atmosphere. In fact a surgeon, Dr. Rigney D'Aunoy, Medical Consultant of the Charity Hospital in New Orleans, prepared the first specifications requiring explosion-proof operating room lights, so you see the electrical industry had to be prodded by a doctor. We should not let this happen again and it will if we, in the electrical industry, fail to take advantage of the progress made and form plans to correct conditions in the both new and existing hospital buildings.

Some time ago it became evident that some agency should attempt to gather all available data and construct therefrom a set of standards to make hospitals a safer haven for the ill. The National Fire Protection Association thought this might best be accomplished by persons having at their disposal not only the necessary medical and other professional skills but also the experimental facilities required for special study, so this fire and accident prevention organization appointed J. Warren Horton, Professor of Biological Engineering, Massachusetts Institute of Technology as Chairman and let him select his committee. Following a considerable number of experiments and the investigation of gaseous explosions as well as the various safeguards tried by many hospitals, standards were drafted and have now been printed in pamphlet form by the National Fire Protection Association. As yet these standards are considered only as recommendations, but no doubt they will very soon be given general acceptance especially by the medical profession. Should you desire, you may obtain copies of this pamphlet from the above mentioned organization for 20 cents each by addressing their office located at 60 Batterymarch Street, Boston, 10, Massachusetts.

Hazardous Areas

The behavior of materials and of mechanical agents can be relied upon with greater assurance than can the behavior of human beings. Consequently these standards have been designed with the intention of reducing the conscious human effort necessary to assure safety. In the first place the

HOW TO WIRE OPERATING ROOMS

1. All wiring and equipment shall be of type approved for Class I Group C location.
2. Circuits shall be isolated from other building circuits by an insulating transformer located outside the hazardous area.
3. Circuits shall be ungrounded with overcurrent devices on both sides of the line.
4. Voltage shall not exceed 115 volts.
5. A ground indicator shall be provided through a resistor of not less than 10,000 ohms connected across the circuit with a relay connected from midpoint to ground.
6. All overcurrent and protective devices shall be outside the hazardous area.
7. All exposed metal parts of electrical equipment and lamps shall be grounded.
8. Low voltage circuits shall conform to the same rules as 115 volt circuits.

GROOM

Explosive anesthetics create serious life hazards. The danger of electrical ignition can and must be controlled. This timely article tells how.

ANESTHETIC GASES are highly explosive. Electrical ignitions can be avoided by special wiring and static eliminating methods.

hazardous area is defined as a room in which any combustible gas is stored or used, and the hazardous condition may be considered as extending for a horizontal distance of ten feet and to a height of seven feet above the floor outside of any door opening into such a room. The only exception to this may be made in rooms properly ventilated when the hazardous condition within the room may be considered as extending only to a height of seven feet from the floor. Such ventilation may be assured by providing a change of not less than twenty cubic feet per person per minute with not less than twelve complete changes per hour with the air brought into the room by ducts opening not less than six feet from the floor and discharged through two or more ducts with at least one not more than three feet above the floor and one in the ceiling. This air must not be recirculated.

Equipment

All electrical equipment and wiring methods employed within the hazardous area must be of the type approved by the National Electrical Code for use in a Class 1 Group C location. All electrical circuits within these areas should be fed by an insulating transformer which isolates them electrically from the main feeder and from other circuits in the building. This transformer should preferably be of the dry type and should be located outside the hazardous area. The primary winding should never be connected directly to a high voltage circuit but should be energized from the main feeder supplying the regular distribution panels in the building. Both sides of the secondary circuit should be ungrounded, and an approved overcurrent device should be provided in each side of every branch circuit connected thereto and the voltage across these ungrounded circuits should not exceed 115 volts. In addition to the usual control and protective devices, the ungrounded system should be provided with a ground contact indicator arranged as follows: A resistor of not less than 10,000 ohms should be connected across the secondary of the transformer and a relay should be connected with its winding between the midpoint of this resistor and ground. The relay should operate when either side of the ungrounded circuit is grounded. A signal lamp showing a green color installed in some conspicuous location should be connected to the back contact of the relay so that it will be lighted when no current flows through the relay winding. A signal lamp showing a red color installed adjacent to the green lamp should be connected to the front contact of the relay so that it will light when current flows through the relay winding.

All overcurrent and other protective devices should be placed outside the hazardous area. Exposed noncurrent carrying metal parts of all electrical equipment, including portable lamps or other appliances, should be grounded. All grounding should conform to the requirements found under Section 5025 of the National Electrical Code.

All lighting fixtures must be of the explosion-proof Class 1 Group C type unless the room is properly ventilated. In such cases permanently mounted lamps either fixed or adjustable that are so constructed that no part of them may be brought within seven feet of the floor need not be explosion-proof; also lamps set in or behind walls in housings ventilated independently of the atmosphere of the room and from which this atmosphere is excluded by substantial vaportight glass windows, no portion of which is within five feet of the floor, approximately

flush with the wall. If possible, such fixtures should be so arranged that they may be relamped from outside the room to avoid disturbing the vapor-tight seal of the glass window. Electrically operated clocks and other signaling apparatus should also be protected in this same manner.

Rubber covered conductors for portable lamps and appliances should have insulation not less than 3/64 inch thick, and shall be of the type designated for hard usage such as Type S. Such cords must contain one extra insulated conductor having an outer finish colored green to be used for the grounding of exposed noncurrent carrying metal such as lamp guards, motor frames and other metal portions of the appliances. Portable lamps should not be equipped with switches but should be turned on or off at the explosion-proof outlet receptable.

All belting used on rotating machinery should have incorporated in it sufficient conductive material to prevent the development of electrostatic charges. All pulleys should be of the conductive type and the conductive path from pulley to ground should be assured especially when sleeve bearings are used.

Many hospitals desire a low voltage circuit for the operation of certain types of electrical apparatus or equipment. Wiring, outlet devices and portable cords similar to those used for the 115 volt circuits must be used and the transformer supplying the current should be of the insulating type and located outside the hazardous area. When instruments, apparatus or other equipment that has exposed current carrying parts are energized from such a circuit, the maximum voltage should not exceed six volts.

Diathermy and X-ray equipment should be provided with an approved form of grounded electrostatic shield. All switches and control devices for such equipment should be located outside the hazardous area.

A hot wire or radio-frequency cautery cannot be safely used in hazardous areas.

Elimination of the electrostatic hazard presents an even more difficult problem than does the correction of the electrical installation and equipment. Deaths have been caused simply by stroking the hair of patients and from lifting a corner of a woolen blanket while the patient was recovering from the effects of the anesthetics. Nurses walking between the sterilizer and the instrument tray and even the anesthetic gases flowing through the rubber tubes of the anesthesia machines have generated sufficient electrostatic current to cause explosions. The method utilized in an attempt to eliminate this hazard was humidification of the rooms as static currents dissipate readily when the relative humidity is kept above sixty percent. This, however, is not always practical and while it does lessen the hazard materially, it is not considered sufficiently reliable.

Testing Conductive Floors

It is felt that the best method of safeguarding the hazard is accomplished by eliminating all strictly nonconducting material, furniture and other movable objects from these rooms. The floor should preferably be covered with a conductive rubber flooring material and arrangement should be made for periodic tests of the resistance of such flooring. The electrical contractor can test such a floor as follows:

The electrode should have a circular area of five square inches, weigh five pounds and have a brass contacting surface. The resistance of the flooring between this electrode and ground should be measured by some form of ohmeter which is capable of maintaining a voltage of not less than 90 volts nor more than 500 volts across a resistance of one megohm, and the resistance should not be more than 250,000 ohms from any part of the floor to ground. All furniture should be equipped with conductive nonmetallic leg tips or casters and the resistance between the metal frame and a metallic plate placed under any one supporting member, but insulated from the floor, should not exceed 250,000 ohms. Inasmuch as special clothing, including conductive shoes, should be worn within these rooms, a direct reading ohmeter should be installed outside but adjacent to the hazardous area with two insulated electrodes so located that a person may stand in a normal manner with one foot on each electrode. Shoes should be tested at least once each day and the maximum resistance permitted between the electrodes is one megohm.

Where it is impossible to have a conductive floor, persons and objects most likely to be in the region of the anesthesia machine should be electrically connected by means of a high resistance device known as an intercoupler. This should be so arranged as to maintain a conductive path between any two bodies of the intercoupled group, or between any one body and ground, and the resistance should be not less than 200,000 ohms or more than 1,000,000 ohms. Any intercoupled group should include the patient, the anesthetist, the operating table and the anesthesia machine. Contact with persons is usually established by means of an anklet or wrist strap.

In order that you may be acquainted with a few of the reasons behind the need for the complete revamping of the electrical installations in rooms in which gaseous anesthetics are used, it seems fitting to include in this article a resume of the hazards involved. Some time ago while a group of surgeons was discussing the problem with me, a very prominent doctor said that a patient was only operated upon after all other curative methods known had failed and therefore if the use of an anesthetic, without which the operation could not be performed, indirectly results in death, it should be considered as an unfortunate occurrence especially when one realizes that the number of explosions resulting in death is relatively very small when compared with the total number of gaseous anesthesias. Possibly on the overall scheme of life in general such thought is proper, and were there no

[Continued on page 204]

PROPERTIES OF ANESTHETIC GASES

Anesthetic	Ignition Temperature	Explosive Limits in air %		Explosive Limits in oxygen %		Chemical Formula	Density Air = 1
		Upper	Lower	Upper	Lower		
Ether	356° F	1.85	36.5	1.7	39.5	$(C_2H_5)_2O$	2.56
Ethylene	914° F	2.75	28.6	3.1	79.9	C_2H_4	.97
Cyclopropane	930° F	2.4	10.3	2.45	63.1	$(CH_2)_3$	1.46
Propylene	927°	2.2	9.7	. . .	52.8	C_3H_6	1.45
Nitrous Oxide		Supporter of Combustion				N_2O	1.52
Chloroform		Practically Non-flammable				$CHCl_3$	4.12

New loads consisting mainly of infra-red lamps have increased the substation capacity from three 50 kva. units to a total of 900 kva. Note the board above the two 3 phase banks on which are mounted the primary disconnects. Note also the angle-iron posts with split-block porcelain insulators which carry the 220 volt three phase secondary mains into the switchboard.

POTTERIES SAVE WITH INFRA-RED

Drying time and curing cut with open rack type infra-red oven in pottery manufacturing.

THAT smooth shiny finish on porcelain bath tubs is the result of baking at several thousand degrees, beyond the reach so far of infra-red ovens. But, in preliminary casting pottery manufacturers are learning important time short-cuts through the use of infra-red equipment.

At The Pottery Company in Trenton, N. J., where the production of quality ceramic tubs is a highly scientific business, infra-red ovens have been adapted to several operations, cutting production costs and handling losses. A couple of years before the war, they started experimenting with a few infra-red lamps and came up with some data on its use in the manufacture of ceramic ware. Then along came the war and cast-iron tubs were out and the entire plant converted to making ceramic tubs.

The tubs are cast in plaster of paris molds from a liquid ceramic material which is about 30 percent water. In actual pounds this may amount to as much as 50 pounds of water in a large size tub. The plaster of paris mold absorbs about 12 to 14 percent of the moisture, which is enough to solidify the casting so that forms can be removed.

Under original production methods, the jelly-like casting was allowed to stand (cure) overnight for some 12 or 14 hours. The next morning all casting ridges and grooves were smoothed and the tub then removed to the drying room where three weeks were lost

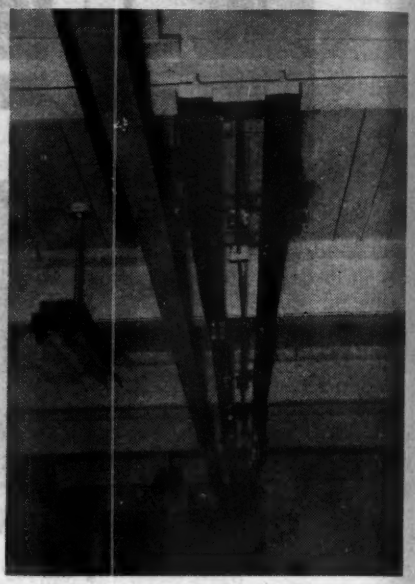
in removing the rest of the moisture. And because the tubs are so fragile at the end of the curing period, the losses in handling were of serious proportion.

The experiments with infra-red heat were carried out on a series of clay tubs. Thermometers were applied to all sides. Lamps were placed on various spacings at various distances and angles to the surface while temperatures were read to get the depth of heat penetration, time required, rate of moisture evaporation, etc. The lamps could not be spaced too close for concentrated heat was found to caseharden the tube, sealing moisture within, and causing checks and cracks in the surface. Optimum spacings were finally found which would transmit infra-red heat energy at a definite rate to give uniform heating and drying throughout the entire mass. It was also found that the shape and amount of surface was more important than the actual amount of bulk to be dried; and that uniform surface coverage regardless of varying thickness, was highly desirable.

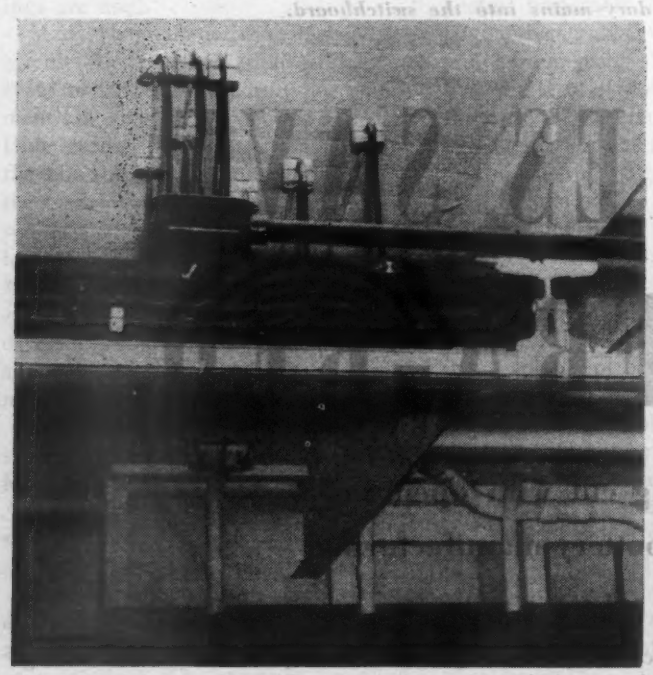
With the infra-red equipment, tubs are poured in the late afternoon and allowed to stand overnight. Next morning forms are removed and infra-red racks turned on to cure the tub in one hour. They are then finished smooth and racks are turned on again to completely dehydrate the casting in sixteen hours. With present spacing of infra-red lamps, the clay temperature gradually rises to 130 degrees F., after which the moisture content has been reduced to less than five percent. Drying continues until the moisture is reduced to less than one percent when the mass assumes constant weight. The fragile tub no longer has to be handled and losses from this source have been entirely eliminated. The former bottleneck, the drying room, has also been eliminated and production rates have shot up beyond all expectation.

The casting floors, too, somewhat on the bottleneck side, were always crowded with tubs curing or waiting removal to the drying room and leaving little or no space to set up new molds for the next pouring. These same floors are now neatly divided into units, each with enough space to set two tubs; one curing and finishing, and one space for assembling new mold. This permits an output of one tub per unit area per 24 hours.

Thus, per unit production costs have been reduced by increased production within the same floor area, and through the elimination of handling losses.

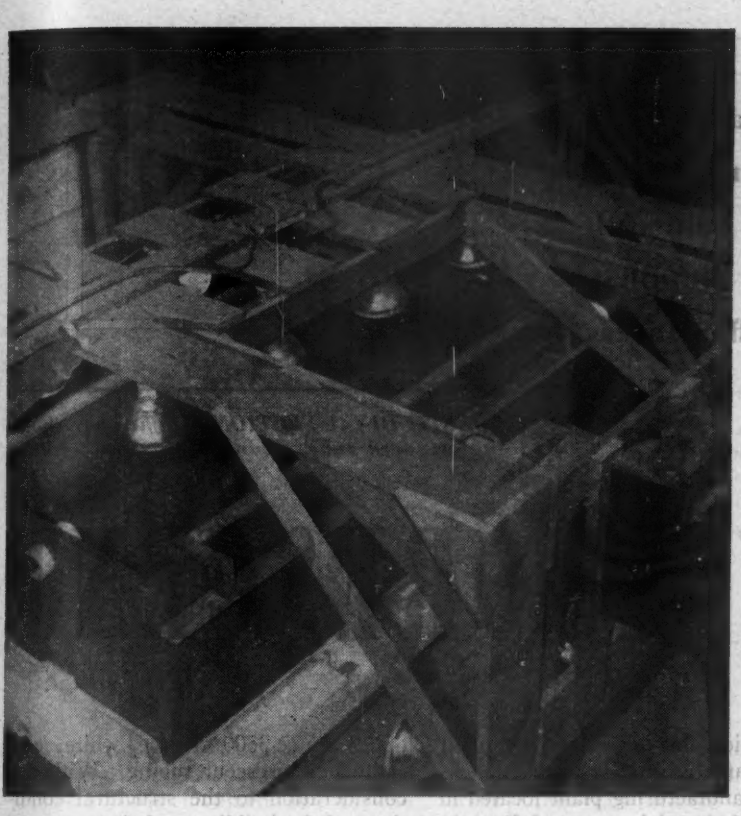


Running boards such as this carry the 400 ampere, 220 volt, three phase circuits down the entire length of the casting floors. At each column a tap-off is made, and a conduit drop is used to bring a full three phase circuit down the post to a fused disconnect switch and three phase receptacle.

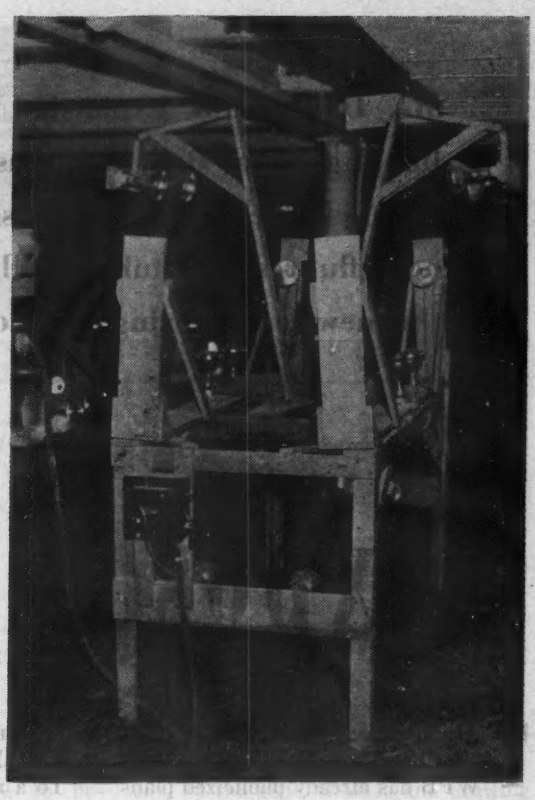


Branch circuits fan out from the 3rd floor switchboard in open wiring. In other plants, plug-in bus duct had been installed, and is much preferred for the infra-red load. However, wartime conditions at time plant No. 5 were expanding and compelled the use of open wiring.

Three phase 220 volt mains rise to switchboards such as this on each floor. The 1200 ampere switch serves as the main disconnect for the three 400 amp. branch feeder switches.

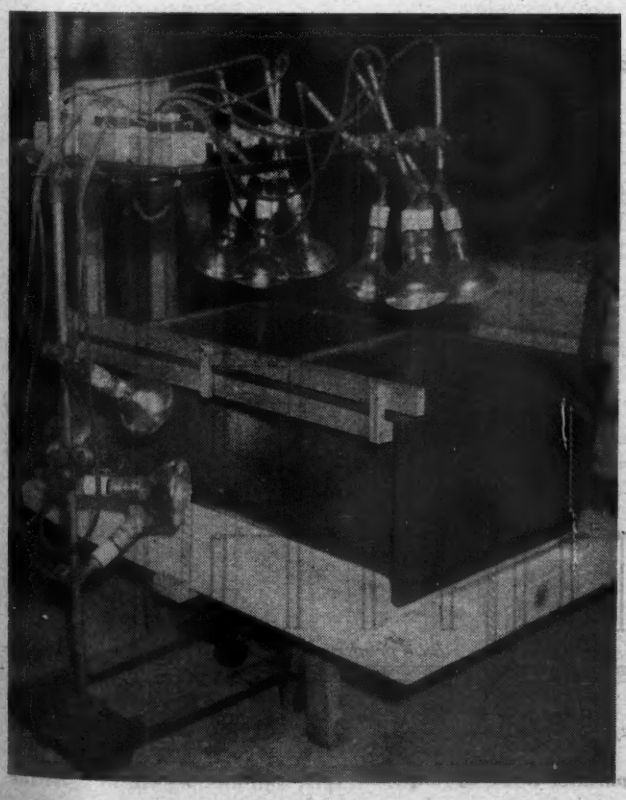


Portable bath-tub drying racks are wired open with twenty 250 watt lamps balanced on three phase. Two 110 v. lamps are series across the 220 v. lines. Each rack is equipped with a 60 amp. safety switch with flexible extension cord and plug.



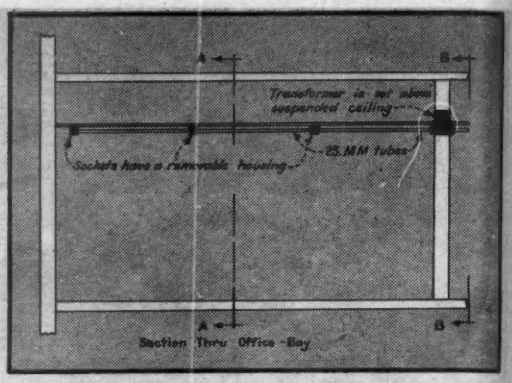
Racks are designed of light wood to facilitate handling by two men. The body is hinged so that it can be folded and moved aside to conserve space. Open type rack preferred over enclosed type because of the elmination of ventilation equipment and duct work.

New bracket type of open rack developed for drying smaller units provides sufficient flexibility for drying a number of miscellaneous types of ceramic ware. Rack is mounted on four-wheel truck. Three single phase duplex receptacles are wired to balance the lamp load.



Trapeze brackets such as these are slung between paint spray booths to speed the drying of the three or four slip and glaze coats applied prior to firing the ceramic ware in the furnaces. Only a few minutes are required for each coat.

MA Day means expansion and better lighting to a Detroit industrial plant. Parallel lines of reflectorless cold cathode fluorescent tubes will illuminate the new engineering and office areas.



***LONGITUDINAL SECTION** of office bay showing standard tube mounted direct to ceiling.*

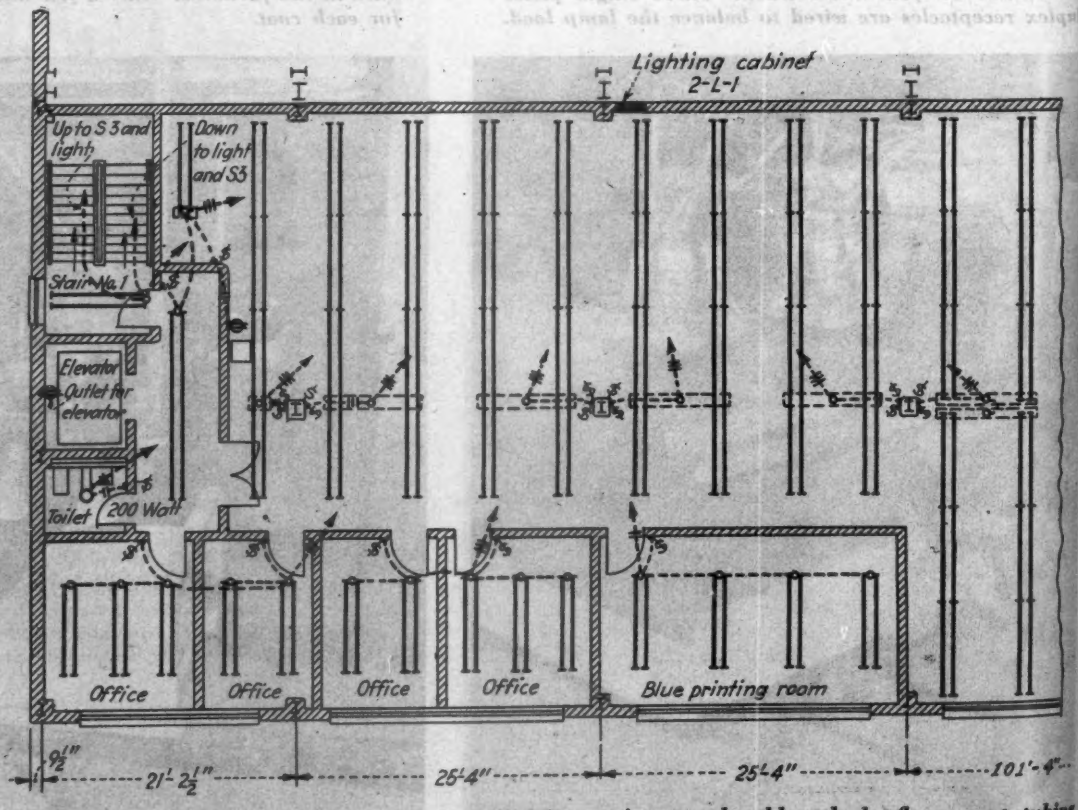
Exposed FLUORESCENT

THERE is real promise that "Material Available Day" is not far off. WPB has already publicized plans for getting partially underway for reconversion construction. In some cases whole new plants will be built to meet the requirements of projected peacetime production; in others there will be only expansions and extensions. And, in still other cases while no new plant will be built, the many production changes being contemplated will have considerable effect on the plant electrical and lighting systems.

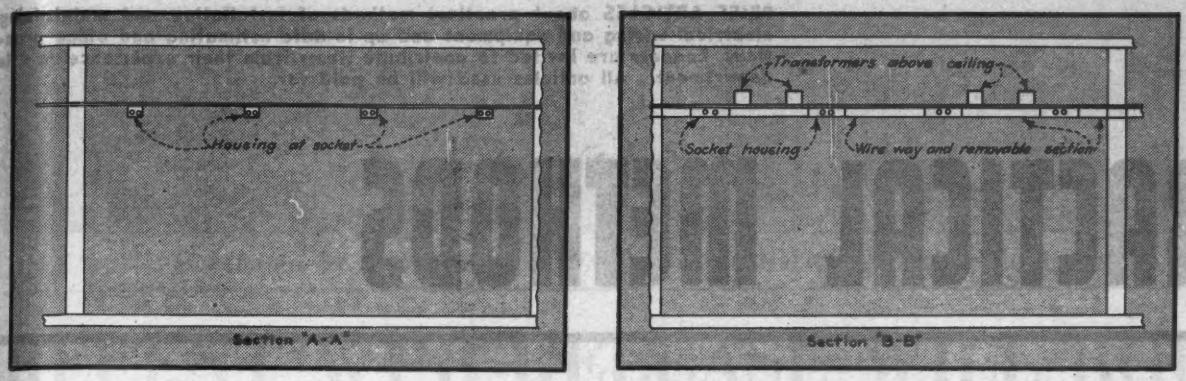
To a manufacturing plant located in the great industrial center of Detroit, MA day means the expansion of present facilities. While expansion will include both plant and office area, only the proposed office lighting plans are presented here.

The lighting design for the engineering and office areas as now proposed call for the installation of parallel lines of 25 mm, 3500 degree white, cold cathode fluorescent tubing. With due consideration to the structural conditions of the building and the comparatively low brightness of the 25 mm tubing, it was decided to utilize the cream colored ceiling as the reflecting surface and dispense with enclosing glass for diffusing, or shielding louvers.

Continuous lines of tubing, utilizing the standard 7 ft. 9 in. lengths, will be installed in parallel sections direct to



Plan view showing the arrangement of parallel lines of exposed cold cathode fluorescent tubing



Cross sections A and B of typical office bay showing the spacing of the dual tube sections, furred ceiling and transformer mountings.

T OFFICE LIGHTING

the 10-ft. ceiling. Each section will be composed of a dual line of three standard tubes mounted end to end and approximately 12 inches center to center (total of six tubes per section). Parallel sections are to be mounted on 6-ft. 4-in. centers.

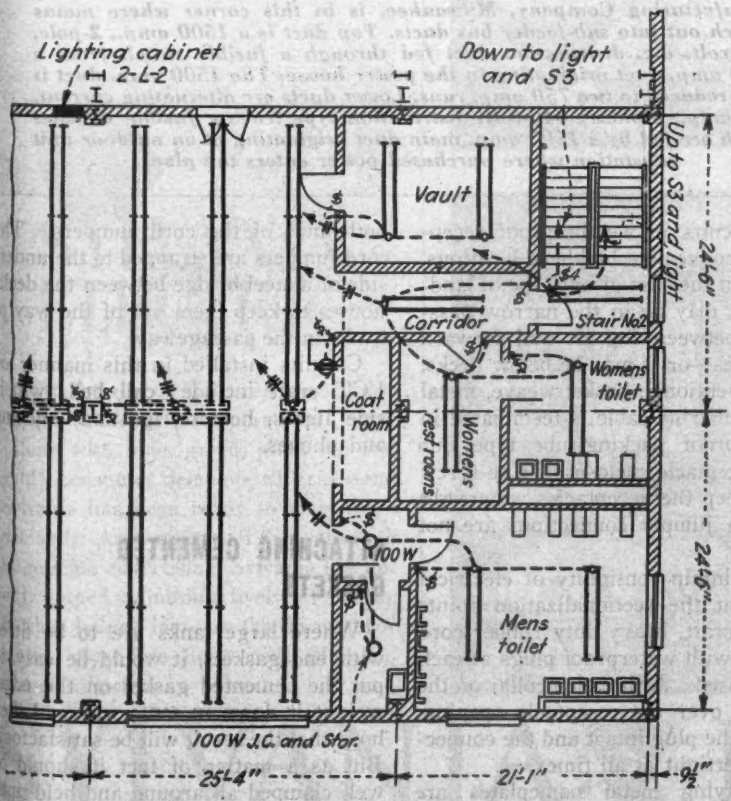
The tubes will be operated by 12,000-volt, 120 milliampere transformers, each transformer serving two sections of lighting (total of 12 standard tubes). To prevent an outage of all lamps connected in series on the single transformer (in case one lamp should break) the transformers are to be equipped with center taps (mid-point grounded units) with the tubes connected in such a manner that a single tube outage will affect only six lamps—or one lighting section. The tubes can be removed and replaced as quickly as can the conventional hot cathode fluorescent lamps.

The transformers are to be concealed in metal enclosures and balanced on the 240/120 volt, 3-wire, single phase system. In the general office and drafting room areas, circuiting consists of two tube sections (12 tubes) per circuit—four sections per 3-wire circuit. Lighting will be controlled by column mounted toggle switches, each serving two six-tube sections of lighting. In the private offices the plans specify sections of four parallel single tubes, the number of sections ranging from one to four, depending upon the physical size of the office. Such units are to be controlled by a switch at the office entrance. In areas such as the blueprint room, fan room, wash rooms, etc., two-tube sections are to be installed on 6-ft. 4-in. centers or wider spacing depending upon the lighting intensity required for the work at hand.

To provide the calculated 40 foot-candles of evenly distributed, shadowless illumination on the working plane in the office areas, it is estimated that approximately 1¼ miles of tubing (more than 850 standard 7-ft. 9-in. tubes) will be required for the two-story, 220-ft. by 50-ft. building. The instant start, low brightness and long life characteristics of the cold cathode tube—resulting in low maintenance cost—were prime factors in the decision to use this light source.

Future data on brightness ratios, footcandle intensities, and other pertinent factors involved in judging the quality of a lighting system, will accrue from the installation of such postwar lighting designs. This data will undoubtedly influence future practice.

Lighting design by: Giffels and Vallet, Inc., Architects and Engineers, Detroit, Michigan.



installed in the general and engineering offices and adjacent areas.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

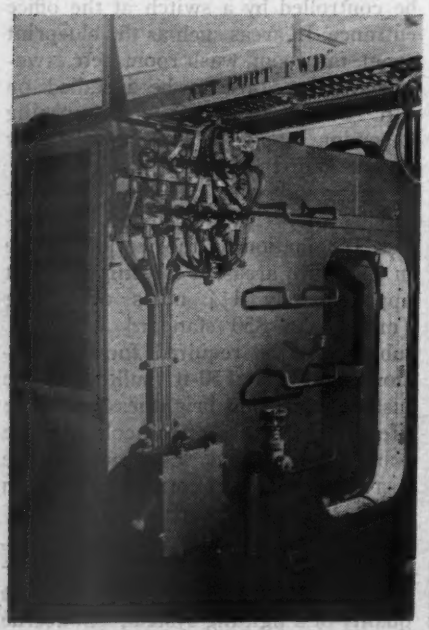
SECTIONALIZED WIRING ON COMBAT SHIPS

WIRING

Thousands of the landing craft used in establishing beachheads on faraway shores are being shipped overseas in sections—to facilitate shipping, conserve valuable space and facilitate the quick replacement of a damaged section should the craft be hit.

With this type of design, naturally, the electrical layout must follow suit. A method of quickly connecting the arteries of the electrical system when the craft is re-assembled or repaired had to be devised. The answer lay in a sectionalized design utilizing heavy duty rubber cord "jumpers" at the points where the ship sections were to be re-assembled.

Basically, the method employed—as indicated by the LCT wiring installations made by the Tri-State Armature and Electrical Works, Memphis, Tenn. —embodies the termination of electrical circuits in weatherproof receptacles at convenient bulkhead locations. This, as in the case of one type of landing craft, may be in the narrow passageway between the aft and forward deckhouses—or it may be below decks. The conventional, basket-weave, metal armored marine cable is terminated in a waterproof packing-tube type hub in the receptacle enclosure. Cap-screw covers keep the receptacles watertight when the jumper connections are not made.

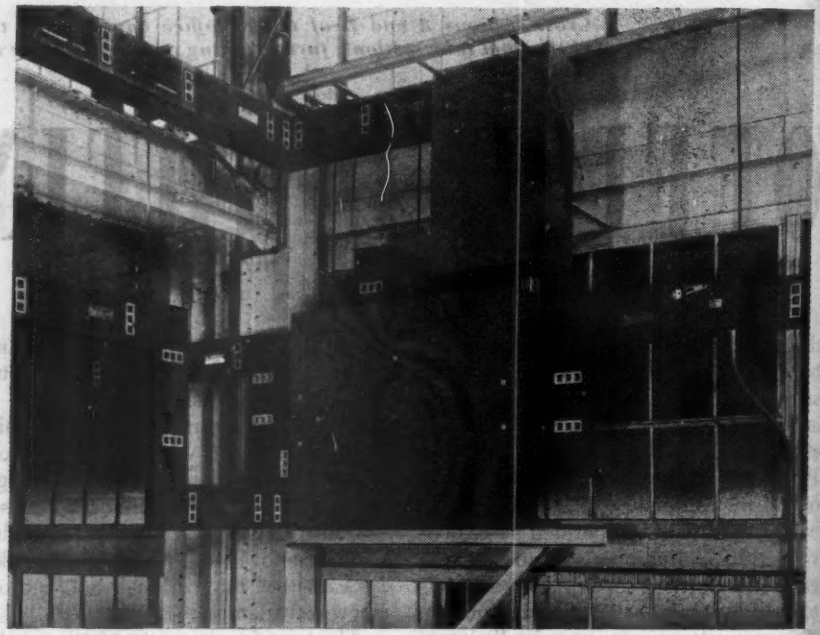


Sectionalization Point on exterior of LCT deckhouse, showing waterproof receptacle terminus of circuits and rubber cord jumpers with plug connections. Receptacles and both ends of cords have identifying nameplates.

To maintain continuity of electrical circuits at the sectionalization points in LCT craft, heavy duty rubber cord jumpers with waterproof plugs at each end are used. A threaded collar on the plug fits over the receptacle opening, keeping the plug intact and the connection watertight at all times.

Identifying metal nameplates are attached to the receptacle outlets and both ends of the cord jumpers. The cord jumpers are strapped to the underside of a steel bridge between the deckhouses to keep them out of the way of traffic in the passageway.

Circuits installed in this manner on LCT craft include: call bell, winch, side lights, heaters, ignition, lighting and phones.



Power dispersal point for inferior plant distribution at Nordberg Manufacturing Company, Milwaukee, is in this corner where mains branch out into sub-feeder bus ducts. Top duct is a 1500 amp., 2-pole, 230 volt, d.c. distribution duct fed through a fusible switch from a 2000 amp. duct originating in the power house. The 1500 amp. duct is later reduced to two 750 amp. runs. Lower ducts are alternating current. 250 amp., 3-phase, 440-volt. distribution type leaving fusible switches which are fed by a 1500 amp. main duct originating at an outdoor unit substation where purchased power enters the plant.

ATTACHING CEMENTED GASKETS

Where large tanks are to be fitted with end gaskets, it would be easy to put the cemented gasket on the edge, weight it down in some way and then hope that the result will be satisfactory. But as a matter of fact it should be well clamped all around and held until the cement is set.

Advertisement

SYLVANIA NEWS
CONTRACTOR EDITION

JULY *Published by* SYLVANIA ELECTRIC PRODUCTS INC., Salem, Mass. 1945

RECENT WPB RELEASE WILL BOOST YOUR FLUORESCENT LAMP SALES!

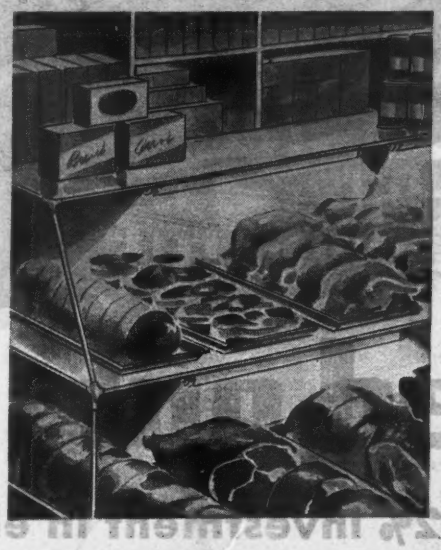
BIG SYLVANIA AD CAMPAIGN BACKS UP CONTRACTOR SALES

Backing up the contractor—helping him cash in on profitable sales of fast-moving Sylvania lamps and fixtures through a big, national advertising campaign—that's one of Sylvania Electric's most important jobs. To do that job, ads like the one shown here speak to the right people—and help contractors *sell!*

With the recent WPB release of those popular Soft White fluorescent lamps (along with blue, green, pink, red and gold) consumer demands will rise—and Sylvania has been ready to meet those demands. As a matter of fact, through large-scale advertising, Sylvania has not only helped maintain a lively interest in, but has helped increase the demand for better, glare-free fluorescent illumination of all types.

The Sylvania Soft White Fluorescent Lamp is back in production! Recent WPB order has removed restrictions on manufacture of Soft Whites—which is a big factor concerning contractors' potential sales.

As you know, the Soft White fluorescent lamp is the most important type for the kind of uses illustrated here:



1. It is the best fluorescent illumination for all meats—necessary to butcher shops, delicatessens, restaurants, cafeterias.

2. It is especially suitable wherever it is desirable to accentuate warmer-tinted merchandise.

3. It is the light required for the flattering of flesh tones and complexions—as in beauty shops, and powder rooms in hotels, restaurants, and theatres.

These Sylvania fluorescent lamps are now *in stock*, ready for shipment, in the sizes *you* want. Also available again are: Blue, Green, Pink, Red and Gold. *For further information call or write Sylvania Electric Products Inc., Salem, Massachusetts.*

SYLVANIA ELECTRIC

MAKERS OF FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

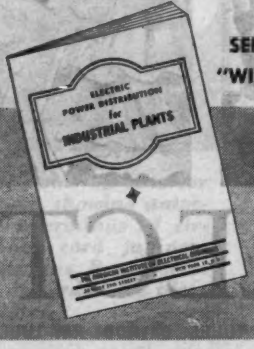
ALL BRANCHES OF THE ELECTRICAL INDUSTRY
benefit from adequate wiring. Get behind this activity, gearing your selling efforts to it. (This message appears before owners, management and architects.)

blacked out

by a 2% investment in electrical distribution

The right plans today can prevent electrical "growing pains" tomorrow. Adequate wiring today can make old or new buildings ready for load upswings tomorrow. Seldom before has the selection of a power distribution system been such a key decision — important far beyond the two to ten percent of the plant investment which the system represents.

Seldom before has so much effective help been available in making the right choice and avoiding the profit-paralyzing consequences of the wrong selection. One example is the new book "Electric Power Distribution for Industrial Plants" published by the American Institute of Electrical Engineers. (It's obtainable for $1.00 from the Institute's offices at 33 West 39th St., New York 18, N. Y.) An entire chapter on wires and cables recognizes their key importance in providing plenty of power for plenty of years. For further help in selecting wires and cables, go over your plans with an engineer of The Okonite Company, Passaic, New Jersey or The Hazard Insulated Wire Works Division, Wilkes-Barre, Pa.



SEE CHAPTER SIX
"WIRES AND CABLES"

ADEQUATE WIRING THE KEY TO INCREASED PRODUCTION

ARMY NAVY

HAZARD

insulated wires and cables

4879

Gaskets are held in place firmly with C-clamps and wood block circle segments until cement sets.

To have a great number of clamping rings for this purpose standing around, to exactly fit every diameter of tank, would be impracticable. Instead of that, the Quality Electric Co., Ltd., of Los Angeles, has made up a number of wood segments of circles each about six inches long. When the gasket is laid on, the segments are placed on top all the way around and only a short distance apart. Each segment is then pressed down by a C-clamp engaging the under side of the flange, as shown in the photograph.

No attempt was made to cut segments of different radii. They are all alike. In fact, rectangular blocks of wood could be employed. But the segments give a partial fit on most circles and do not leave sharp corners jutting out over the edge. They also present a more finished appearance.

STAPLE DRIVER AND TEST LAMP

Instructions for making a tool for driving insulated staples, and for preventing substitution of incorrect voltage lamp bulbs in test lamps, as suggested by Thomas Trail, Baltimore, Maryland, are given below.

The tool for driving insulated staples can easily be made from a wornout screwdriver. One that can be hammered upon without splitting should be used. The point of the screwdriver should first be ground off as indicated in Fig. 1 (a). Then a shallow slot should be filed lengthwise in the end of the shank, as illustrated in Fig. 1 (b).

In use, after a staple has been started with a slight hammer blow, it can be driven home with this convenient tool without damaging area surrounding.

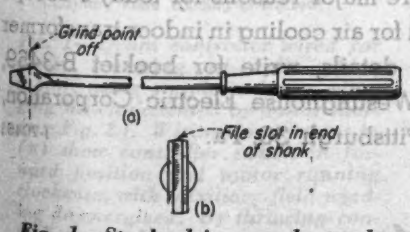


Fig. 1—Staple drive can be made from old screwdriver. (a) Grind off end of screwdriver shank. (b) File shallow slot lengthwise in end

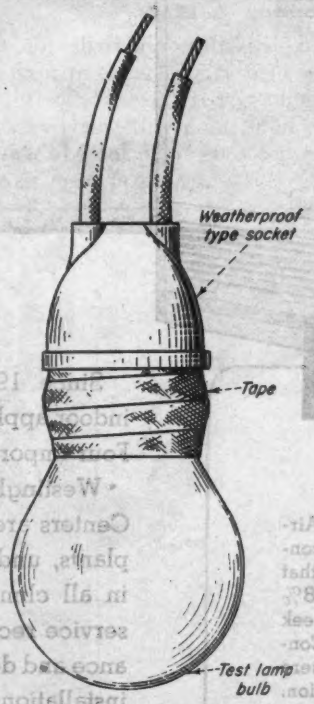


Fig. 2—Taping socket and lamp together on test lamp prevents use of wrong voltage lamp.

Fig. 2 shows the socket and lamp bulb of a test lamp taped together, which will keep the bulb tight in the socket and will help prevent a bulb of lower voltage being unintentionally substituted for the correct voltage lamp.

SPLIT PHASE MOTOR DIRECT REVERSING CONNECTION

WIRING

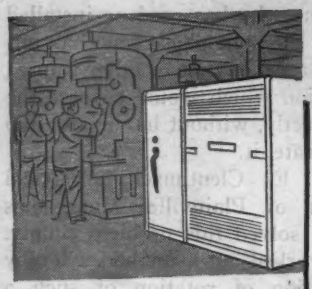
Everyone who has used or installed motors of the split phase type has undoubtedly at some time or other wanted a connection which would reverse the motor directly, without having to stop or decelerate it.

George E. Clentimack, electrical contractor of Plainville, Mass., has faced and solved this problem simply. He has worked out a method whereby the direction of rotation of such a motor may be reversed merely by throwing a switch from forward position to reverse position, or vice versa. His solution involves a reversal of connections to the auxiliary field winding, through the use of a simple double end mercury tube type plugging switch. Fig. 1 shows the necessary wiring connections on a drum controller, with the mercury plugging switch connected between the controller and the motor. Fig. 2 shows how the mercury plugging switch is activated by a drum on the motor shaft.

The centrifugal switch on a split phase motor is held open at speeds near normal full load rpm. Therefore, to reverse the direction of rotation of the motor when running, it is necessary to short circuit the centrifugal switch in order to energize the auxiliary field winding. By reversing the leads on this winding when it is energized, the direction of rotation will reverse, because of a 180 degree phase displacement.

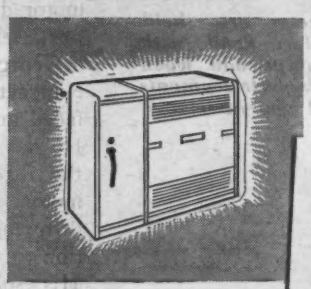
Any device which will provide these required connections may be used. The connections shown in Fig. 1, are easily traced. With the drum controller switch in forward position, line 1 feeds through 1-R to 3-F to A, through the main winding to B, and back through 4-F to 2-R and to line 2. Line 1 feeds to point A on the main winding with the controller switch in either forward position or reverse position. Reversing the main winding leads when motor is running will not reverse the direction of rotation. When the controller switch is in the forward position, as in Fig. 1 (a), the auxiliary field winding is de-energized when the motor is running near normal full load rpm. In this case the motor is assumed to be running clockwise. The centrifugal switch, E, is open. With clockwise rotation the mercury plugging switch, sometimes called a friction switch, connects points F and G as shown in Fig. 1 (a). Line 1 thus feeds through 1-R, 1-F and 1-O to 5-O, 5-F and C on one side of the auxiliary field winding.

4 reasons why AIR is today's best insulating medium for indoor transformers



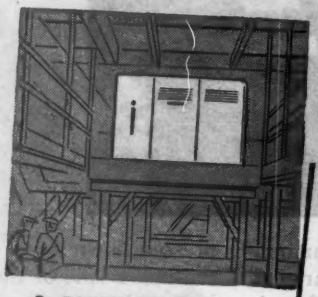
1. SAFER

Air cooling eliminates fire and explosive hazards. No inflammable liquids—no internal gas pressures, because no sealed tank is needed.



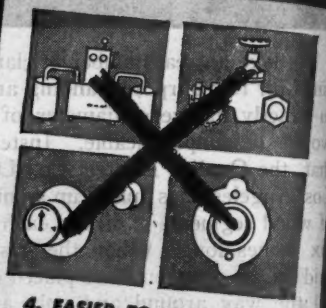
2. CLEANER

Air cooling does away with liquid seepages and liquid reconditioning. Coils easily cleaned with compressed air when used in very dirty atmosphere.



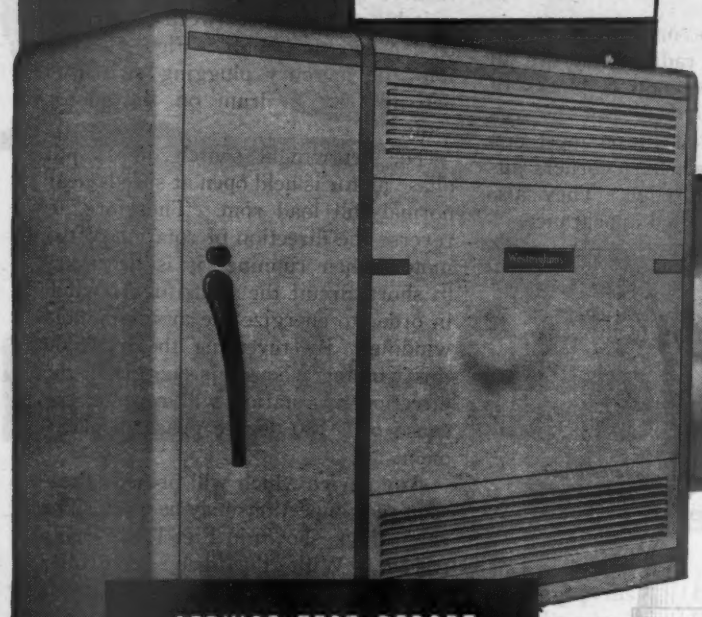
3. EASIER TO INSTALL

Air-Cooled Transformers need no vaults, catch basins or relief vents. Install them anywhere —on the floor or overhead.



4. EASIER TO MAINTAIN

No time out for liquid inspection, filtering or reconditioning —no pipes, fittings, valves or gaskets to maintain with Air-Cooled Transformers.



SERVICE TEST REPORT

WITHSTANDS 95% HUMIDITY

In the tropics, a Westinghouse 150 kva Air-Cooled Transformer has been operating continuously for two years in an atmosphere that remains constantly between 95% and 98% humidity. Transformer is loaded 6 days a week and remains energized over the week end. Condensation conditions are severe, but to date, there have been no indications of insulation deterioration.

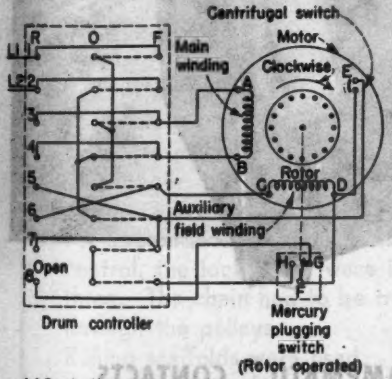
Since 1936 the trend of transformer design for indoor applications has been towards AIR COOLING. Four important reasons why are shown here.

Westinghouse Air-Cooled Transformers and Power Centers are in service today in all types of industrial plants, under widely varying extremes of conditions, in all climates from subarctic to the tropics. Their service records are major reasons for today's acceptance and demand for air cooling in indoor transformer installations. For details, write for booklet B-3459, "Air Cooling". Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70451

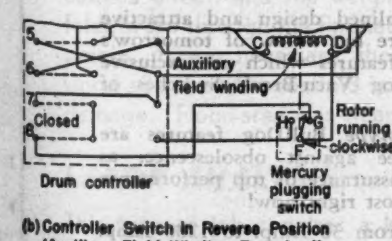
Westinghouse *Air Cooled* TRANSFORMERS

With the centrifugal switch open, line 1 feeds through the winding to D, thence to F and G in the mercury plugging switch, and to 8-R. With the controller switch in the forward position, this leaves the circuit open at 8-R, hence the auxiliary field winding is de-energized.

To reverse the direction of the motor, the controller switch is thrown from forward position to reverse position. The main winding continues to be energized the same as with the controller switch in the forward position. The auxiliary field winding becomes energized, with the motor leads reversed, as shown in Fig. 1 (b). Line 1 now feeds through 1-R, 1-F, 1-O to 5-O, 5-R and 6-F. Since the motor is still running, centrifugal switch E is still open. With the motor still running clockwise, the mercury plugging switch still connects points F and G. Hence, line 1 continues from 6-F to 7-F and 7-R, through the switch to 8-R and to point D on the winding through points G and F in the plugging switch. The auxiliary winding now becomes energized with the leads reversed, since the current flows through the winding to C, and back to line 2 through points 5-F, 6-R through



(a) Controller Switch in Forward Position (Auxiliary Field Winding De-energized)



(b) Controller Switch in Reverse Position (Auxiliary Field Winding Energized)

Fig. 1—Drum controller wired for direct reversing of split phase motor, using simple mercury plugging switch activated by motor shaft (see Fig. 2). Wiring connections in (a) show controller switch in forward position and motor running clockwise, with auxiliary field winding de-energized. By throwing controller switch to reverse position, auxiliary field winding is energized as shown by wiring connections in (b) and motor reverses direction.

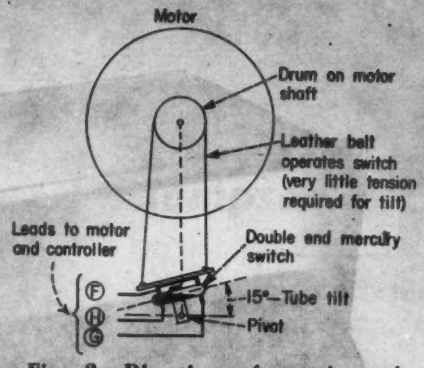
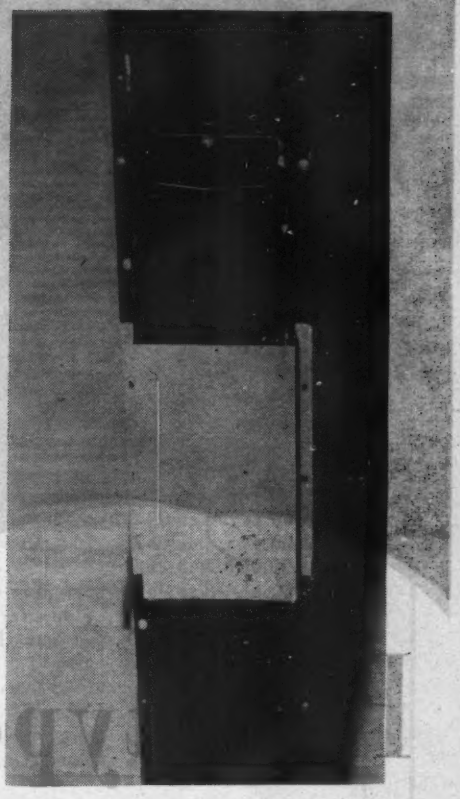


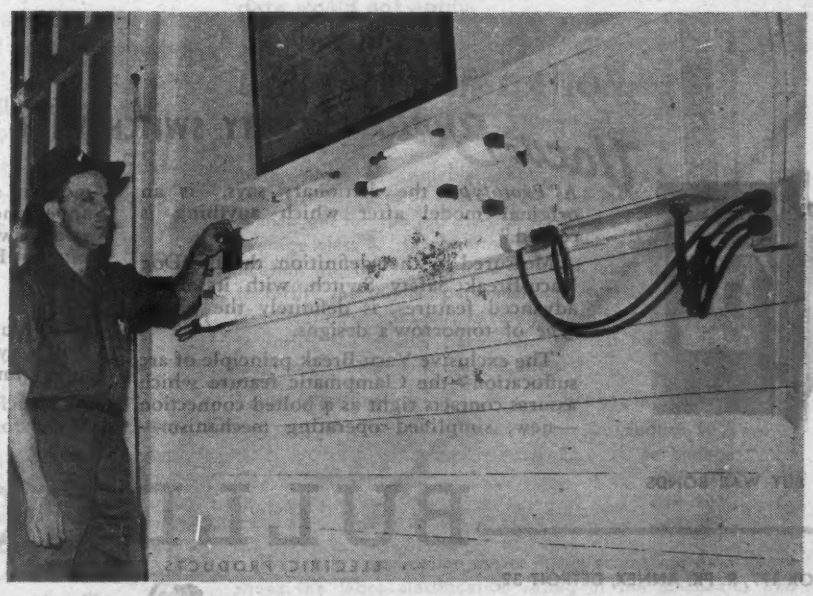
Fig. 2—Direction of rotation of motor shaft operates simple mercury plugging switch, permitting auxiliary field winding of split phase motor to be energized at 180 degrees phase displacement, causing reversal of direction. Change in direction of rotation of motor breaks plugging switch circuit, and motor operates normally.

the controller switch to 6-O, 2-O, 2-F and 2-R.

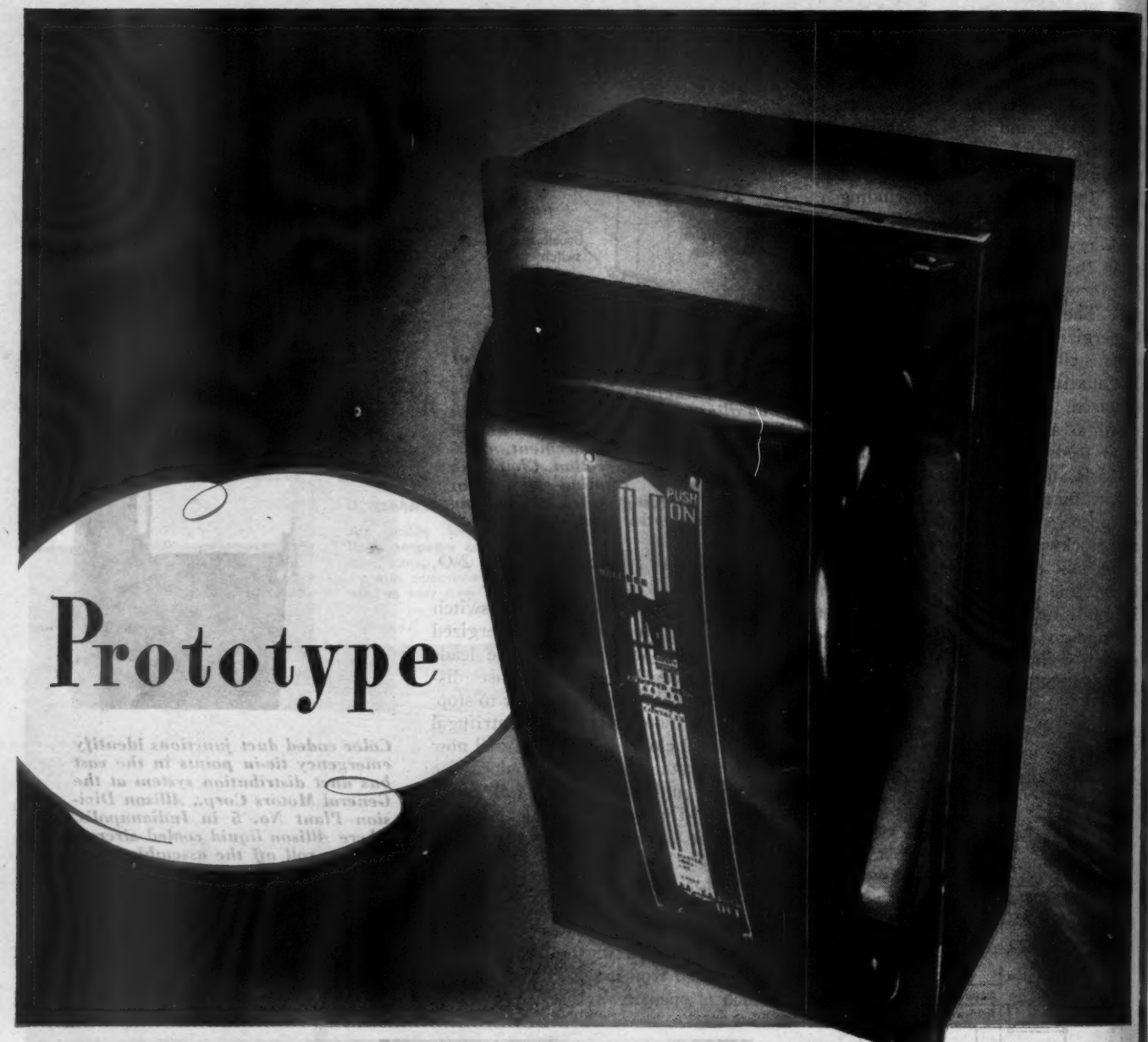
Since changing the controller switch from forward to reverse has energized the auxiliary winding with the leads reversed, the 180 degree phase displacement will cause the motor to stop. When the motor stops, the centrifugal switch will close. The motor will now begin to rotate in a counter clockwise direction until it picks up full speed, at which time the centrifugal switch will open and the motor will operate normally. The change in rotation of the motor shaft automatically opened the circuit to the auxiliary field winding through the mercury plugging switch by connecting point F to point H. A lead from point H is connected which is open in reverse.



Color coded duct junctions identify emergency tie-in points in the vast bus duct distribution system at the General Motors Corp., Allison Division Plant No. 5 in Indianapolis, where Allison liquid cooled aircraft engines roll off the assembly lines. These breaks in busbar continuity (busbars are unbolted and equipped with insulating sleeves) occur at approximately 250-ft. intervals in the continuous bus duct. With covers painted a bright yellow color, these junctions can be quickly spotted in an emergency.

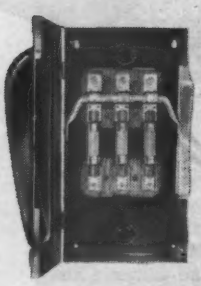


Fluorescent test board at the North American Aviation, Inc., Texas Division plant provides a quick and easy method of checking new and reused fluorescent lamps, starters and ballasts before installation. J. B. Houston, who helped design and build the tester, demonstrates its operation. Unit will accommodate 6, 10, 15, 20, 30 and 40-watt as well as Type RF fluorescent lamps.



Prototype

Vacu-Break SAFETY SWITCH WITH "CLAMPMATIC" CONTACTS



A *Prototype,* the dictionary says, "is an original model after which anything is copied."

Measured by that definition, the BullDog Vacu-Break Safety Switch, with its many advanced features, is definitely the *prototype* of tomorrow's designs.

The exclusive Vacu-Break principle of arc suffocation—the Clampmatic feature which assures contacts tight as a bolted connection—new, simplified operating mechanism—modern streamlined design and attractive appearance—are but a few of tomorrow's safety switch features which are exclusive in the BullDog Vacu-Break Switches of today.

These *prototype* BullDog features are your guarantee against obsolescence, as well as your assurance of top performance at minimum cost right now!

Capacities from 30 Amp. to 1200 Amp. Write for illustrated folder.

BUY WAR BONDS

SALVAGE PAPER

BULLDOG

ELECTRIC PRODUCTS COMPANY

BOX 177, R. PK. ANNEX, DETROIT 32, MICHIGAN. In Canada: BullDog Electric Products, Ltd., Toronto. Field Engineering Offices in All Principal Cities.

Also Manufacturers of
SafToFuse Panelboards—Switchboards—Circuit Master Breakers — BUStribution DUCT, for "plug-in" power — Universal Trol-E-Duct, for flexible lighting—Industrial Trol-E-Duct, for movable "loads."

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

XF1

Installation Of Thompson Fixture Hangers

BUILDING CONSTRUCTION:

Large naval drill hall. Large arched wood trusses set on concrete base approximately 10 ft. above floor level with high point of arch approximately 35 ft. above floor level. Roof joists tie in from truss to truss. Floor was finished wood on sleepers and fill over concrete base. Building approximately 350 ft. long by 125 ft. wide.

NATURE OF JOB:

One hundred ten 500-watt Pittsburgh mirrored glass reflectors were installed on Thompson hangers to permit lowering the fixture to the floor for relamping and maintenance.

JOB CONDITIONS:

There were rooms on both sides of the drill hall. The trusses projected out of the side rooms at a point approximately 16 ft. above the finished floor in the drill hall. The high point was approximately 35 ft. above the floor.

The Thompson hanger has a base and a removable portion for lowering. The base mounting holes were wider than the roof joist and it was necessary to add a short piece of 2" by 4" wood at the side of each joist in order to lag the base up securely.

The hangers are controlled by a chain which loops through a system of pulleys to a lock box on the wall. For appearance, as well as centralizing the points of control, the lock boxes were installed in groups of three. The chain had to be trained to these points through the pulleys.

Rolling scaffolds were used. The fill did not come up to the top of the sleepers, giving the floor a cushion effect, and the weight of the rolling scaffolds broke through the finished floor at a number of points. It was necessary, thereafter, to place plywood ahead of the scaffold to prevent further floor damage. Floor area was clear.

LABOR ANALYSIS:

This type of job requires a high degree of initial planning. The work will only occur on high ceilings, etc., and the job conditions will greatly alter the labor data. For a relatively small job a separate item of initial setup should be considered.

The labor units show an average, but the units at the conclusion of the job had descended from higher initial units when the mechanics were unfamiliar with the work.

LABOR DATA FOR COMPLETE JOB

Equipment	Man-Hours	
	Unit	Total
440 —Pulleys	0.25 ea.	110.00 M.H.
110 —Hangers	0.50 ea.	55.00 M.H.
110 —Lock Boxes	0.20 ea.	22.00 M.H.
44 —Suspension Fittings	0.40 ea.	17.60 M.H.
6500′—Chain	2.00 C′	130.00 M.H.
110 —Reflectors—wire, etc.	0.40 ea.	44.00 M.H.
110 —Reflectors—assemble, install guards, etc.	0.20 ea.	22.00 M.H.
Total Installation Time		400.60 M.H.

Note:
The above labor units include time for moving scaffolds by mechanics who did nothing else but keep the mechanic on top supplied with materials.
The time does not include the scaffold erection time and dismantling. (See other labor units.)
The suspension fittings listed above were used where the roof arch was too severe for the fixtures to hang plumb.

For small jobs add 75 percent to the units, plus initial setup. (This would only apply against the hanger, chain, pulleys, etc., and not against fixture wiring or assembly.)

If floor was congested a percentage would have to be applied.

If rolling scaffolds could not be used, entire labor data would not apply.

LABOR CLASSIFICATION:

One "A" man and balance "B" men.

The types of available labor are rated A-B-C-D-E, with the units based upon average use of B labor. In general, an A man will run the job assisted by B and C labor, which will average class B. In abnormal times the general labor classification will fall to D and E for new labor being employed to fortify the regular personnel. It must be noted that the classification applies only to rate of time and not to knowledge to fortify the regular personnel. It must be noted that the C from a rate of time classification.

Labor Classification	Changes in Standard Units
A	deduct 10%
B	no change
C	add 10%
D	add 20%
E	add 30%

The labor classification shown in the estimating date above shows the labor classification rating of the mechanics who performed the particular job so that adjustment can be made on the type of labor available.

Data From L. W. Witz, Continental Electrical Construction Co., Chicago, Ill.

SOAKEROO

Like the hide on the amphibious old fellow above, the jacket for U. S. Royal Cords and Cables is tough and waterproof. It *has* to be to give the service engineers expect when they specify "U.S. Royal".

We make sure of it by submerging these cords and cables, hour after hour, in a bath that is a real "soakeroo". You could safely use them even at the bottom of the ocean!

Rough treatment is the rule for a whole series of tests our scientific inspectors make of U.S. Royal Cords and Cables. They are heated, frozen, compressed, stretched, bent. And they have to pass with a mark of 100%. That's why they have all the qualities you need . . . no matter how tough your conditions are.

THE NEW U. S. ROYAL *Safety Tested* ELECTRICAL CORDS AND CABLES

Listen to "Science Looks Forward"—new series of talks by the great scientists of America—on the Philharmonic-Symphony Program. CBS network, Sunday afternoon, 3:00 to 4:30 E.W.T.

UNITED STATES RUBBER COMPANY

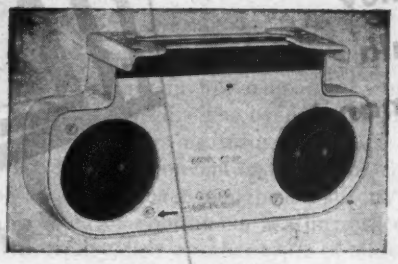
1230 Sixth Avenue, Rockefeller Center, New York 20, N. Y. • *In Canada:* Dominion Rubber Co., Ltd.

SERVING THROUGH SCIENCE ***WITH ELECTRICAL CORDS AND CABLES***

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

EQUIPMENT NEWS

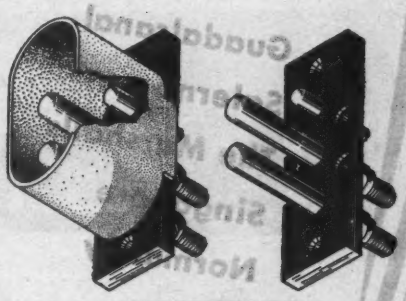
Fluorescent Lampholder



G-E LAMPHOLDER

A fluorescent lampholder, known as the Twin Turret, has been announced. It is made for use with 40 watt lamps. It has a metal casing with insulated face and holds two Mazda F fluorescent lamps. Starter sockets are an integral part of the lampholder and are located between the lamps. They will accommodate either FS-40 G-E watch dog starters or conventional FS-4 starters. Some of the features include easy mounting, simplified wiring and new method of operation. The lampholder can be mounted on any flat surface with two screws. Tinned and stripped leads can be inserted through entrance holes in the face of the lampholder. Each Twin Turret has two discs with holes for the pins of lamps. Lamps can be inserted by depressing either disc of lampholder with one end of the lamp until the other end clears the disc in the opposite lampholder and slips into place. Lampholders can be used in single, double and triple pairs or in special arrangements. General Electric Company, Bridgeport, Conn.

Battery Receptacle



CANNON RECEPTACLE

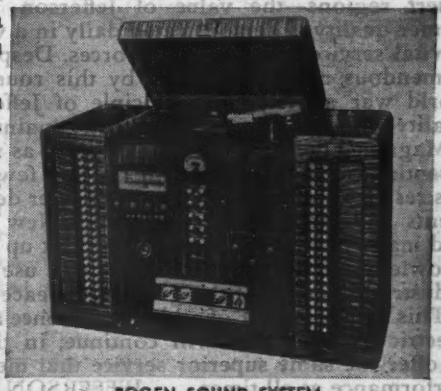
A new three-contact battery receptable has been released. The fitting mates with any standard AN-2551 plug, and is adaptable to aircraft starting equipment and other uses. Contacts are brass with silver plate finish and meet AN capacity requirement; one negative, one positive. Large contacts are 7/16 inch in diameter; small ones 5/16 inch in diameter for indicator light. Receptacle panel is phenolic, drilled for two mounting holes. Shield is die-cast aluminum alloy. Four eyelets fasten shield to panel. Four combinations are available; AN2552-1, complete fitting with shield and three pin contacts; AN2552-2, shield less small pin contact; AN2552-A1 panel without shield but having small pin contact and AN2552-A2, panel without small pin contact. Cannon Electric Development Company, 3209 Humboldt Street, Los Angeles, 31, Calif.

Circuit Tester

AUTH CIRCUIT TESTER

This circuit tester is a portable, low voltage type, intended for use in making tone and direct current continuity tests, checking fuses or lamps, and pairing wires in cables. It is for testing all types of circuits of low resistance for open or closed condition. Unit should not be used on any live or energized circuit. It consists of tubular molded phenolic flashlight case with slide type cutoff switch, high pitch buzzer, utility clip for fastening to belt and flexible insulated leads with test prods. It uses two standard size "D" flashlight cells. Auth Electrical Specialty Co., Inc., 422 East 53d Street, New York, N. Y.

Sound System



BOGEN SOUND SYSTEM

The SW 80 is a new sound system featuring complete program supply and intercommunication facilities. It includes an all-wave, high fidelity radio tuner, loudspeaker, two amplifiers, 12 inch turntable with automatic record changer optional and two microphone pickup channels for program supply. The system provides full intercommunication facilities for up to 80 stations with pushbutton selection and provision for two-way origination of calls. Program pick-up from any of the 80 rooms or locations, single emergency button blanket calls, fading and mixing of four program channels are additional features. This sound distribution system is recommended by the manufacturer for schools, hotels, institutions, hospitals and industrial plants. David Bogen Co., 663 Broadway, New York 12, N. Y.

A WAR TIME SERVICE RECORD

SERVICE RECORD

Guadalcanal
Salerno
The Marshalls
Singapore
Normandy
Aachen
Tulagi

OF JEFFERSON

Sydney
Fedala
Murmansk
Attu
Kiska
Ain Toya
Makin

TRANSFORMERS

Florida Island
Cassino
Luxemburg
Corregidor
Manila
Bataan
Iwo Island

That Means ..... Peacetime Superiority

All over the world—on the Western Front, in the humid tropics or polar wastes to the arid desert regions—the value of Jefferson Transformer quality is demonstrated daily in a variety of vital services to our armed forces. Despite the tremendous need occasioned by this round-the-world war activity, the principle of Jefferson's quality-with-quantity is consistently maintained.

Magnified demand from the military as well as essential war industries during the past few years, has resulted in far-reaching transformer developments and methods of production. New needs, and many new applications have built up a great fund of technical knowledge that Jefferson Electric will use in serving the increased industrial demand of the great new peace era.

This vast reservoir of added experience assures you that Jefferson Electric Transformers will continue, in the future as in the past, to offer the same superior service that means dependable, reliable performance at all times. . . . JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. In Canada: Canadian Jefferson Electric Co. Ltd., 384 Pape Avenue, Toronto, Ont.

JEFFERSON ELECTRIC

TRANSFORMERS

TRUMBULL RAYMERSION OVEN

Infra-red Ovens

A new line of "Raymersion" prefabricated infra-red ovens for high speed heating in low-temperature industrial service has been announced. The ovens are made up entirely of such standard parts as frame members, wall panels, ventilation ducts and conventional control equipment. Ovens of any size, shape and heat capacity can be constructed for batch or continuous heating processes in combination with trolley, belt or other types of material-handling equipment. Some of the applications are baking synthetic enamel finishes on fabricated steel products; preheating castings for impregnation and sealing; baking insulating varnishes on armatures, motor and transformer windings; surface drying of cleaning solutions and rust inhibitive coatings applied to metals; The Trumbull Electric Mfg. Co., Plainville, Conn.

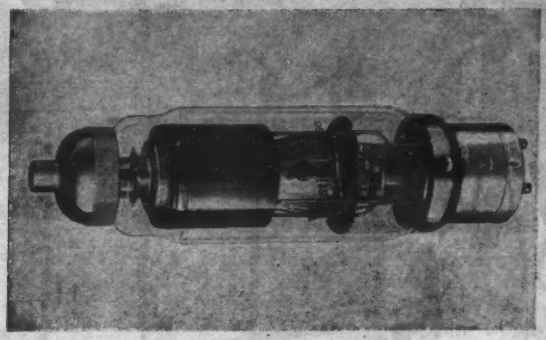
SYLVANIA LAMPS

Black Light Lamps

Black light lamps for industrial, aircraft and marine instrument illumination and many other applications are now available. They are for operation on 120 volt a-c and 24-28 volt d-c circuits. The near ultra-violet RP 12, rated at 4 watts, is designed for use with a visible light filter where a light-weight, compact lamp is required. It is equipped with a polarized bayonet base and may be operated in any position for use with aircraft instruments, inspection or other industrial equipment. Red-purple series tubular lamps require no visible light filter and operate with standard fluorescent lamp accessories on 120 volt a-c circuits. They are supplied in five sizes ranging from the 6-inch T5 rated 4 watts to the 36-inch T8 rated 30 watts. Sylvania Electric Products, Inc., Salem, Mass.

Thyratron Power Control Tube

A new 15,000 volt Thyratron power control tube providing split-cycle control of high power for R. F. heating units and radio transmitters, has been announced. For electronic equipment designers, the Thyratron WL-678 makes possible smooth and instantaneous power control from 0 to 100 percent load; simplified automatic load control; high speed automatic overload protection; low space and weight requirements and low control power requirements. The new grid-controlled mercury vapor rectifier tube is designed to combine the high voltage characteristics of a Kenotron, control qualities of a Thyratron and efficiency of a Phanotron. Lamp Division, Westinghouse Electric and Manufacturing Company, Bloomfield, N. J.



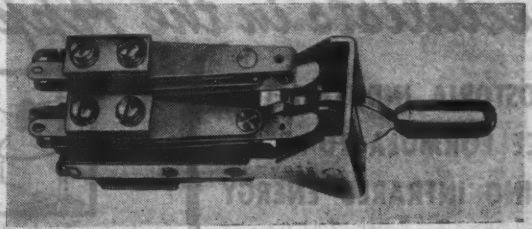
WESTINGHOUSE CONTROL TUBE

Transparent Fibron Tape

A transparent, flexible thermo-plastic tape has been announced. Fibron Tape No. 3 protects wiring, cables and equipment against abrasion. The tape is heat sealing, flame resistant, flexible at low temperatures, and resists attack by acids, alkalies, moisture, oil, grease and corrosive fumes. With proper adhesives, it may be bonded to fabrics, metal, ceramics, wood and other materials. Fibron tapes have been applied as gasketing material; in the construction of automotive and aircraft lighting and ignition harnesses; and in the splicing of plastic insulated wire and cable. Irvington Varnish and Insulator Company, 6 Argyle Terrace, Irvington, N. J.

Lever Switch

Series 4101 extra heavy duty lever switch is for motor starting, stopping, reversing and motor plugging. The design provides flexibility of circuit arrangements. An unlimited series of combinations of contact assemblies are available that may be built up to suit specific requirements. Contacts are rated at 20 amperes, 110 volts, a-c (non-inductive). Contacts of 10 amperes are also available. Donald P. Mossman, Inc., 612 North Michigan Avenue, Chicago 11, Ill.



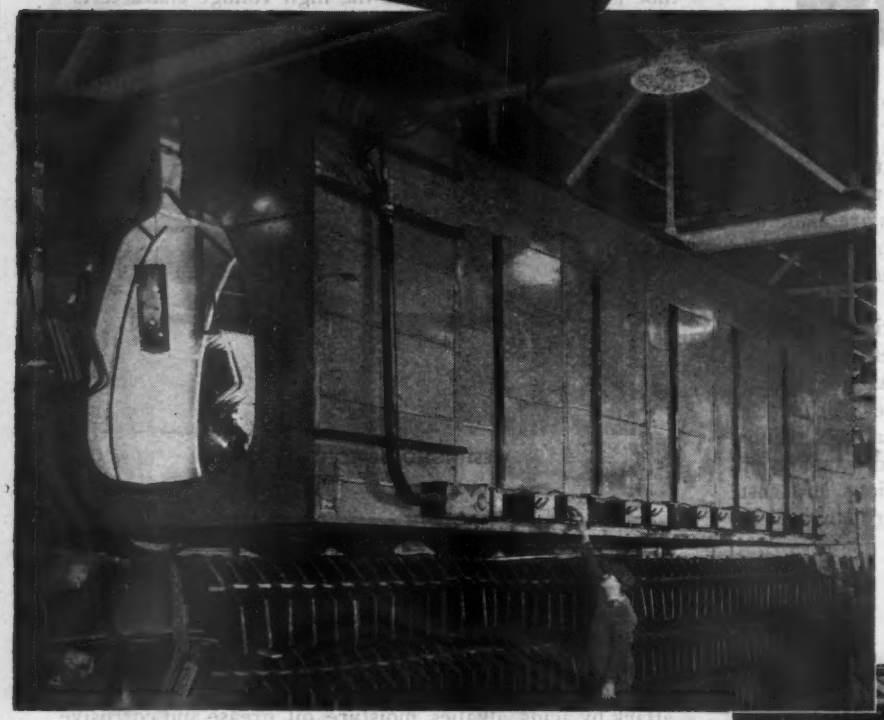
MOSSMAN SWITCH

MANAGEMENT
—PRODUCTION
MEN!

—SPEED
—REDUCE
of Baking

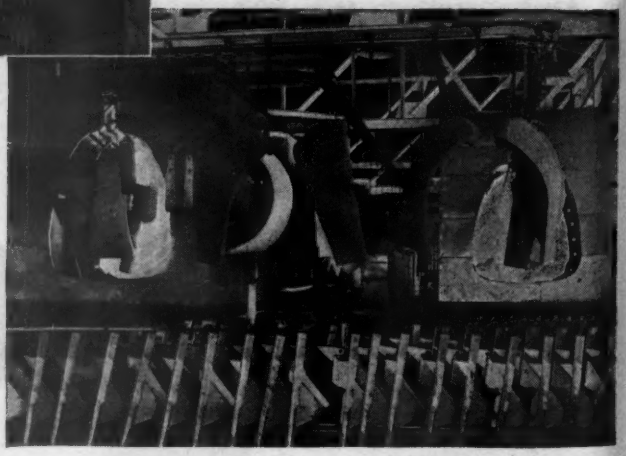
PROVEN BENEFITS OF THE EVENRAY SYSTEM

- *Saves Time*
- *Saves Floor Space*
- *Reduces Rejects*
- *Instant Production*
- *No Stand-by Loss*
- *Visible Operation*
- *Greater Flexibility*
- *Economical Operation*
- *Worker Comfort*



Over 3,000 Fostoria Installations Prove Benefits in Small and Large Operations

Pictured here is a Fostoria installation in the plant of a large automotive manufacturer. The Infrared tunnels, through which painted parts are conveyed for baking, are suspended from the ceiling. This saves valuable floor space for storage or other use. Here, Infrared reduced finish-baking time from 55 minutes to 8½ minutes. Processing starts and stops instantly by switch controls.



FOSTORIA INDUSTRIAL

Specialists in the Application of Near Infrared

THE FOSTORIA INDUSTRIAL SERVICE FORMULA FOR APPLYING INFRARED ENERGY

Study of problem and pretesting for solution

+

Calculation of installation required

+

Supervision of Installation

+

YOUR PRODUCTION OPERATING COSTS

-Drying-Dehydrating-Preheating

Among new industrial methods, Infrared heating stands out as a development of great contribution to faster, better and lower cost production. On baking, drying, dehydrating and preheating operations, processing time reduction of 50% and more is common. In many installations, production has been doubled and tripled without increased floor space. Savings in labor and operating costs are also substantial with remarkable results of improved production on both large and small operations. These and other important benefits make investigation of this new tool imperative NOW to management—production men —either for present or postwar production.

For discussion of the utilization of Infrared, review of case histories applicable to your operations, and inspection of Fostoria Evenray Systems, call one of the Fostoria Industrial Service Centers listed below. This nationwide organization of specialists provides the experience of over 3,000 highly successful installations and the comprehensive technical facilities necessary to pretest and forecast accurately the benefits of Infrared for your specific use.

REQUEST THIS FREE BOOKLET, TODAY

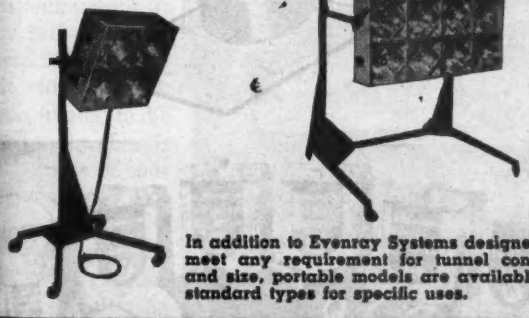
Includes fundamental information about Infrared and the advantages of Fostoria Evenray Systems.

Case history information applicable to your operations will be included if you send us general facts about your baking, drying, dehydrating or preheating problem.

Catalog of portable equipment also available on request.

PORTABLE MODELS

Also available in Fostoria Evenray Equipment



In addition to Evenray Systems designed to meet any requirement for tunnel contour and size, portable models are available in standard types for specific uses.

Highest Efficiency in the Utilization of INFRARED RADIANT ENERGY

EVENRAY SYSTEM

fostoria

FOR BAKING • DRYING • PREHEATING • DEHYDRATING

Trade Mark Reg U S Pat Off

SERVICE

Radiant Energy

= SUCCESSFUL OPERATION

After-installation service

THE FOSTORIA PRESSED STEEL CORPORATION • FOSTORIA, OHIO

Independently Affiliated Manufacturers

Southern Industries, Atlanta, Ga.

Amalgamated Electric Corp., Ltd., Toronto, Canada

Export Sales Dept.
401 Broadway
New York City

LOCATIONS OF FOSTORIA INDUSTRIAL SERVICE CENTERS

ATLANTA
140 Marietta St., N. W.
Main 2757

BOSTON
620 Commonwealth Ave.
Commonwealth 0333

BUFFALO
404 North Oak St.
Lafayette 8135

CHATTANOOGA
1021 Chestnut St.
Phone 6-6194

CHICAGO
747 W. Jackson Blvd.
Randolph 5942

CLEVELAND
4500 Euclid Ave.
Endicott 6622

DAYTON
334 Wayne St.
Fulton 3594

DETROIT
12171 Grand River Ave.
Hogarth 1850

INDIANAPOLIS
548 Massachusetts Ave.
Riley 2934

LOS ANGELES
1206 Maple Ave.
Prospect 7761

MILWAUKEE
104 East Mason St.
Daly 2949

MINNEAPOLIS
2 Foshay Tower
Atlantic 7363

NEW HAVEN
(Hamden, Conn.)
1240 Whitney Ave.
Phone 2-5985

NEW YORK
92 Warren St.
Worth 2-3352

OAKLAND
205 Twelfth St.
Twin Oaks 4475

OMAHA
1102 Farnam St.
Atlantic 5540

PHILADELPHIA
(Bala-Cynwd, Pa.)
349 Montgomery Ave.
Greenwood 4477

PITTSBURGH
5339 Penn Ave.
Highland 9900

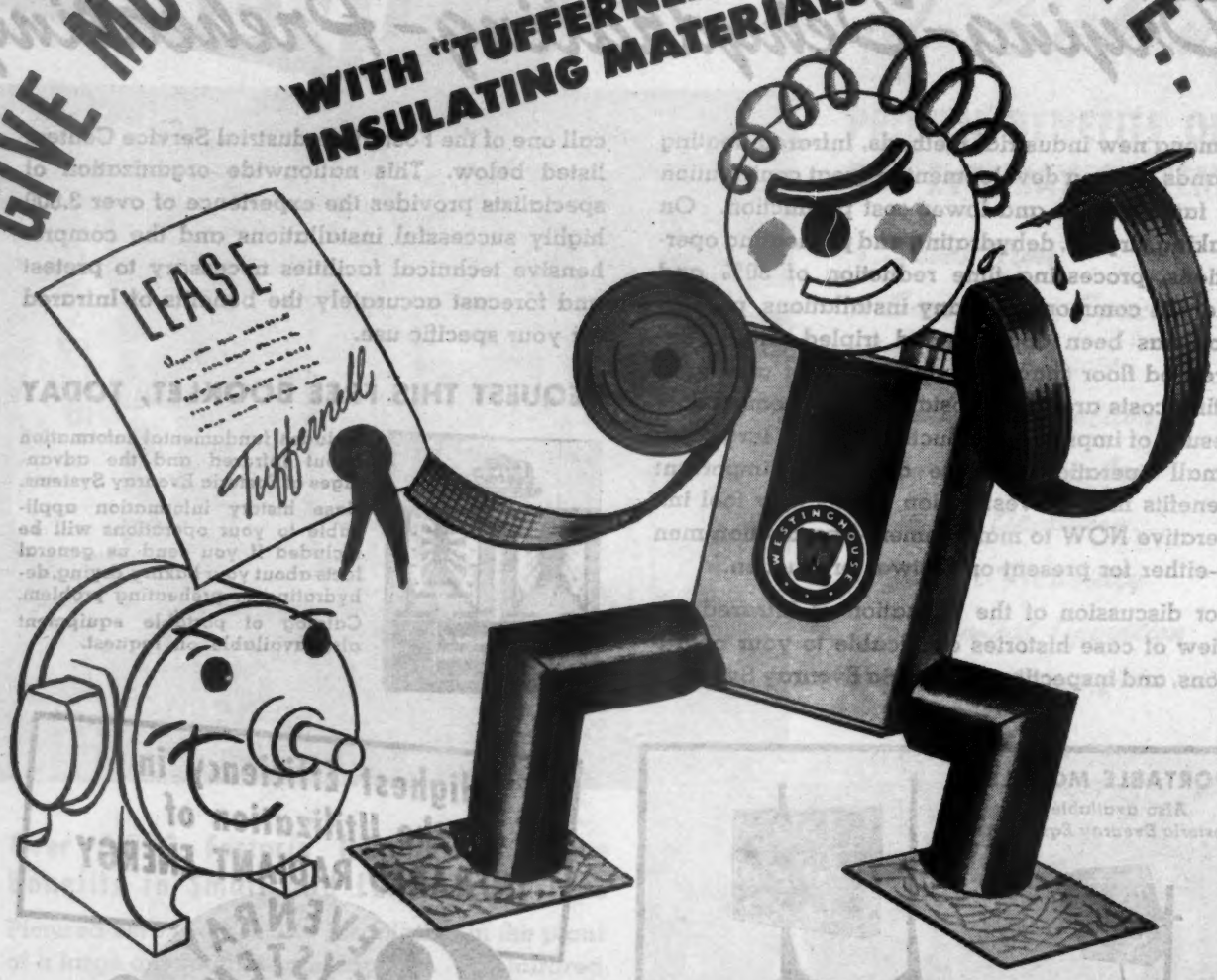
ST. LOUIS
1706 Olive St.
Central 0153

SEATTLE
90 Dearborn St.
Main 0919

CANADA: Montreal • Toronto
Northern Electric Co., Ltd.

GIVE MOTORS A LONGER LEASE ON LIFE..

WITH "TUFFERNELL" INSULATING MATERIALS



Now is the time to make sure that your electrical apparatus will give added years of service . . . without interruption . . . and at competitive efficiency. So, for choosing the correct insulation ask your Westinghouse Distributor about "Tuffernell" . . . a complete line of insulating materials.

"Tuffernell" includes all the usual insulating materials as well as DC-993, a varnish belonging to the sensational chemical family of silicones.

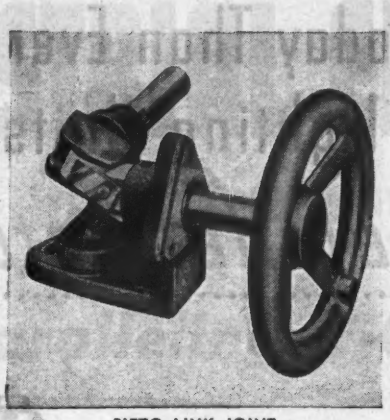
For complete dimensions and application data on mica, fabrics, tapes and papers, get a copy of Catalog 65-000. Write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-06366

Westinghouse Insulating Materials include a complete line of micas, fabrics, tapes, papers and varnishes.

Westinghouse

Insulating Materials

Link Joint



PIEZO LINK JOINT

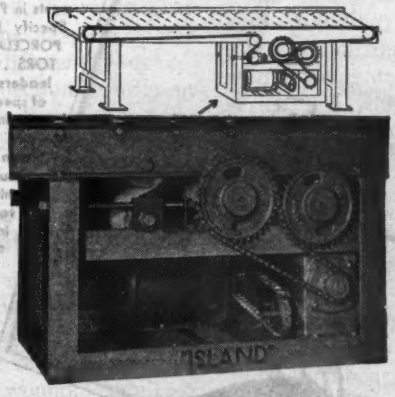
This new Universal link joint is recommended for hand operation and slow speed power drives, such as those used in the control of electrical switchboards, radios, automatic machinery, valve operation and other mechanical devices. It features an adjustable link mechanism to transmit rotary motion around corners, permitting the operation of shafts at angles adjustable from a straight line, 0° to a right angle, 90°. The output shaft turns in the exact angular rotation as the input shaft, giving an input turning angle equivalent to the output turning angle. The joint is mounted by means of three screws which hold it in position. The bearing arm which holds the adjustable shaft may be hinged to any desired position from 0° to 90° and when in its proper location, a locking screw holds its position. Piezoelectric Corporation, 110 East 42d Street, New York 18, N. Y.

Cable and Wire Stripper

IDEAL STRIPPER

A new wire stripper for stripping rubber insulation, asbestos, synthetic, plastic, glass, cambric and other insulations has been announced. Any size of wire or cable, up to $\frac{5}{8}$-inch diameter—single or parallel conductor can be stripped. Parallel wire, heater cord, inner conductors and POSJ cord can be stripped with plain blades. The grooved blades are intended for rubber covered and weatherproof cable. Stripper is simple to use. Wire is laid in position between jaws and cutting blades and then the handle is pulled down. This causes gripping jaws to grasp the wire and draw it through the oscillating blades. Some of the features include straight line pull and elimination of scraping and nicking of wire. Jaws automatically center and grip any diameter of wire without manual adjustment. Jaw releases wire at end of stripping stroke. Blades open automatically to receive wire when lever is pushed forward. Blades are interchangeable. Adjustable stop provides for length of stripping. Grooved blades are available in 15 standard sizes. Ideal Commutator Dresser Company, 1041 Park Avenue, Sycamore, Ill.

Power Unit Conveyor Drive



ISLAND EQUIPMENT POWER-PAC

A new power unit, known as "Power-Pac," for motorizing conveying equipment has been announced. It is a self-contained assembled unit, built in an iron frame, ready to be bolted to the chassis of any piece of conveying equipment that needs to be mechanically operated. Unit consists of motor, driving rolls, switch speed reducers, controls, and gears. The unit measures 15 in. by 24 in. by 17 in. The main pillow block housings to which are attached the main drive rollers, allow ample lubrication at all times. Island Equipment Corp., 101 Park Ave., New York City.

Portable Test Set

G-E TEST SET

A portable a-c test set, mounted on a three-wheeled truck so it can be moved about and plugged into any convenient 115 or 230 volt, 60 cycle outlet, and capable of supplying smooth stepless test voltages from 0 to 15,000 volts, has been announced. Though relatively small—36 inches high, 49 inches long, and 30 inches wide—the set has a capacity of 5,000 volt-amperes and can be used for accurate testing of generators or large motors of approximately 1,500 hp., transformers up to several thousand kva., short lengths of power cable, also insulators and other pole line hardware. The complete equipment consists of a step-up transformer, built-in electric timing clock, double-scale switchboard-type voltmeter for full range accuracy, voltmeter scale selector switch, air circuit breaker with instantaneous overload trip. A 15-foot supply cord and plug, and two 15-foot shielded high-voltage leads with insulated test handles are also included. General Electric Company, Schenectady 5, N. Y.

Paint for Concrete Floors

Rubbermastic paint can be applied to any surface, wet, damp or dry; painted or unpainted; inside or outside; without etching or preparation. It can be used on walls, roofs or floors of concrete, brick, stucco, paper, wood or metal. Its welding qualities effect a vulcanized waterproofing job in colors. Guaranteed Products, 1117 Crenshaw Blvd., Los Angeles, Calif.

There is More Reason Today Than Ever Before to Specify Benjamin Lighting Units with *Porcelain Enamel Reflectors!*

The many important advancements made in all types of reflector finishes have left unchanged the 3 BIG REASONS for Porcelain Enamel's TOP RATING!

Advancements in porcelain enameling make possible lighting reflectors with even greater resistance to weather, chipping, acids, thermal shock, etc. However, while these advancements give added reason for its specification, basically the reasons for its TOP RATING remain the same. They are:

1. DURABILITY

TOP RATING in durability goes to porcelain enamel. Reason: porcelain enamel is an inorganic finish, being literally rock fused on steel. Hence, unlike organic finishes, porcelain enamel is *not subject* to oxidation and deterioration from the effects of time, heat, sunlight and atmospheric conditions.

2. REFLECTIVITY

TOP RATING, here, because with porcelain enamel you get a lighting unit which not only has a light diffusing reflection factor of 80% or more, but also one that will *retain* this efficiency for a *life-time*. For, although the better organic finishes now possess initial qualities of reflectivity the equal of porcelain enamel, only porcelain enamel has been so completely time tested. Years and years of service experience prove that porcelain enamel retains its light reflecting qualities throughout a life time of service without appreciable loss.

3. CLEANABILITY

TOP RATING goes to porcelain enamel. Because its dense, glass hard surface prevents dirt and oils from becoming embedded . . . because of its extreme resistance to scratches, marring, chipping . . . because it cannot oxidize or corrode . . . porcelain enamel surfaces are the most easily cleaned; require only soap and water washing.

ENAMEL SEALS AGAINST CORROSION

To be Sure you Get Reflectors Embodying the Latest Developments in Porcelain Enamel . . . Specify BENJAMIN LIFE-TIME PORCELAIN ENAMEL REFLECTORS . . . Years of pioneer leadership in the development of special light reflecting enamels and finer production methods employed in Benjamin's own porcelain enameling plant insures porcelain enamel of a uniform quality that is warranted to meet all recognized industry specifications including those of the RLM Standards Institute.

Remember: For Durability . . Reflectivity . . Cleanability . . *Specify*

BENJAMIN
TRADE MARK

LIFE-TIME PORCELAIN ENAMEL
Lighting Equipment

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS
BENJAMIN ELECTRIC MANUFACTURING COMPANY
DES PLAINES, ILLINOIS

INDUSTRIAL ELECTRIFICATION

ENGINEERING • INSTALLATION • MAINTENANCE

Paralleling D-C Generators—II

Step-by-step procedure for paralleling compound wound generators, compensated generators, and three-wire machines both shunt and compound.

By H. B. Black
Manager, Large Apparatus & Propulsion Section, Contract Department
Crocker-Wheeler Electric Mfg. Company
Ampere, New Jersey

COMPOUND wound generators, three-wire machines both shunt and compound wound, and compensated generators are somewhat more complicated than the stabilized and plain shunt wound machines discussed in the first article. In some respects, they are similar to the types previously considered, however they differ widely in other respects; their characteristics are different, they require different connections, different adjustments, etc., and are somewhat more difficult to adjust for parallel operation.

Compound Wound Two-Wire Generators

First of all we will consider the compound wound two-wire d-c generator. Fig. 1 illustrates typical inherent generator voltage regulation curves of straight shunt wound, stabilized shunt wound, flat compound wound, and over-compounded d-c generators. Although the curves for straight shunt wound and stabilized shunt wound machines were included in the previous article, they have now been combined in Fig. 1 along with those applying to compound wound generators in order that a ready comparison may be made and their respective characteristics be more readily appreciated.

It will be noted that both of the shunt wound types have a drooping voltage characteristic with any increase in load, whereas the flat compound wound generator inherently provides the same voltage from no-load to full-load. Also, the overcompound wound generator has a rising voltage characteristic with an increase in load.

The stabilized shunt wound generator differs from the straight shunt wound machine in that it has a light series winding previously referred to as the stabilizing field. The compound wound generator also makes use of a series field winding but is made proportionately heavier, sufficient to overcome any drooping voltage tendency. In fact, if the series field is proportioned still heavier with respect to the main shunt field, a rising voltage characteristic will result such as illustrated for the overcompound wound type of d-c generator.

Fig. 2 shows a complete generator and switchboard wiring diagram for the parallel operation of two or more compound wound two-wire d-c generators. It will be noted that the compound wound generator wiring is the same as that of the stabilized shunt wound type, plus a so-called equalizer connection between point A on machine No. 1 and point A_1 on machine No. 2 when the equalizer switches are both closed. It will be noted that the closing of these switches connects the series fields of both generators in parallel; that is, the series field of No. 1 is connected across the switchboard bus at B-C and that of No. 2 at B_1-C_1.

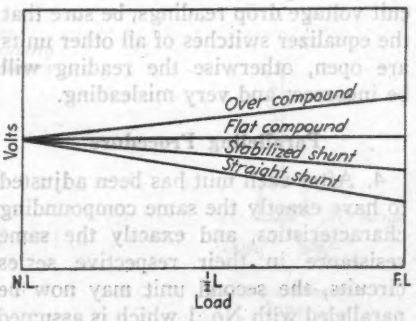


Fig. 1—Generator voltage regulation curves are compared over the no-load to full-load range showing the drooping, flat or rising voltage characteristics that can be obtained from the various types of machines.

Low Resistance Equalizer

For successful parallel operation the equalizer connection circuit must be a low resistance circuit throughout. It was previously the rule that the copper size of the equalizer connection should never be less than 50 percent of the copper size used for the mains, however there is an increasing tendency today to use the same size copper for the equalizer connection as is used for the mains. This latter practice assists materially in obtaining satisfactory parallel operation and is sometimes absolutely necessary. Skimpy copper size for the equalizer connection is an invitation to trouble and should be avoided from the start.

A series equalizer resistor may or may not be required in the negative main, as is shown. (Preferably omitted if possible.) This is discussed later.

Initial Adjustments

The procedure to be followed in adjusting compound wound two-wire generators for parallel operation will be exactly the same as previously given

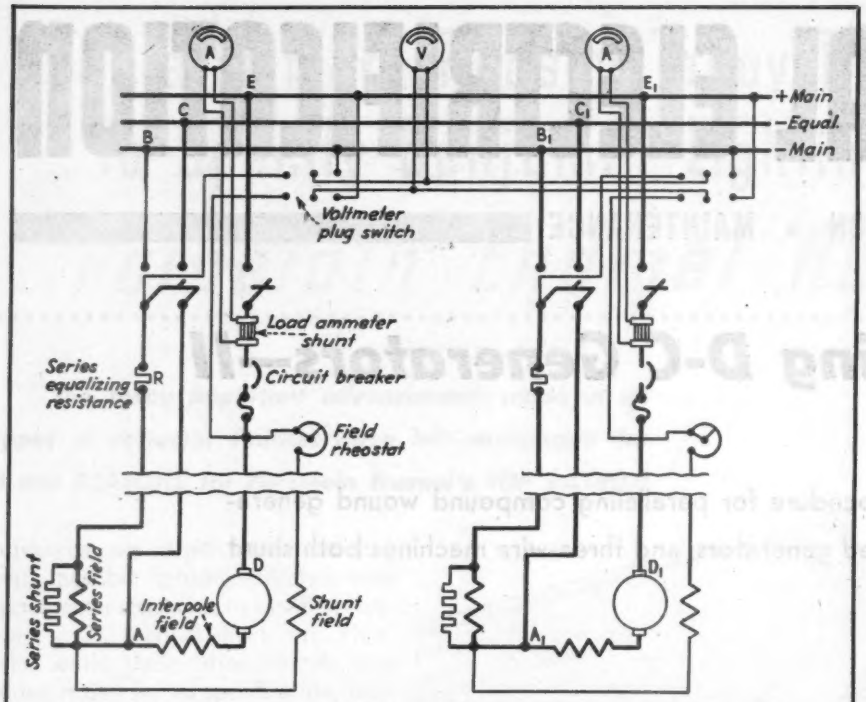


Fig. 2—Equalizer connection is made from point A of No. 1 machine to point A_1 of No. 2 through equalizer bus (C-C_1) on switchboard.

for stabilized shunt wound machines, plus the following additional details:

1. If the generators are flat compound wound, the adjustable series shunt across each series field must be adjusted so that each generator unit develops a flat voltage regulation curve; that is, the rated voltage at no-load and exactly the same voltage when carrying full-load. If the generators are overcompounded to produce a rising voltage characteristic, the adjustable series shunts should be adjusted so that each generating unit to be paralleled develops identical rising characteristics, all starting from the same no-load voltage.

2. When the individual machine compounding adjustments have been carefully made as above, put full-load (at the operating voltage) on an individual machine and measure the voltage drop across its series field. This reading can be taken across two poles of the closed disconnect switch at the switchboard, being careful to read between the negative main and equalizer. This voltage reading will be in the order of from one-half a volt to possibly three volts and must be carefully made, preferably using a 0/3-volt scale volt-meter.

A record of this voltage drop reading should be made for each individual machine and then compared. *They must then all be made to read exactly alike at full-load before satisfactory parallel operation can be expected.* Measuring the voltage drop is merely a means of checking the resistance of the respective series circuits, which on all machines *must* be adjusted identically alike.

3. Consider the machine having the highest voltage drop reading (highest series circuit resistance) as standard. Adjust the voltage drop of the other machine or machines to exactly match that as obtained on the standard machine. To increase the voltage drop, resistance must be inserted in the negative lead, see Fig. 2 (series equalizing resistance R.) Such resistances are not furnished along with the generating equipment and from the practical standpoint in the field, the proper value must be found by the cut and try method. This will be found to vary from one or two iron washers placed between connection terminals in the negative main, to possibly several. A length of strap iron may be required, or when the respective series fields are of very unlike design, a heavy grid resistor may be required. When taking series circuit voltage drop readings, be sure that the equalizer switches of all other units are open, otherwise the reading will be incorrect and very misleading.

Paralleling Procedure

4. After each unit has been adjusted to have exactly the same compounding characteristics, and exactly the same resistance in their respective series circuits, the second unit may now be paralleled with No. 1 which is assumed to be on the board and carrying load. Proceed as follows:

a. See that No. 2 machine switches and circuit breaker are open and that rheostat resistance is all cut in.

b. Bring No. 2 up to rated speed.

c. Slowly adjust rheostat until generator no-load voltage is equal to line voltage (as read by switchboard meter on No. 1 machine) or slightly higher.

d. Close negative series main and equalizer switches.

e. Readjust voltage if necessary.

f. Close main circuit breaker, and lastly, the positive main switch.

g. Adjust field rheostat slightly to make No. 2 take its proper share of the load.

If all of the adjustments have been properly made, the operation and load division should be stable.

Three-Wire Generators

Many installations make use of so-called three-wire d-c generators of various capacities, which are generally used to supply a combined power and lighting load. Such generators are generally wound for 125/250 volts and have three main terminals; that is, positive, negative and neutral. Thus, 250 volts is obtained between the positive and negative mains, while half voltage is obtained between either main and the neutral. The neutral carries only the unbalanced current due to any unbalance or unequal division of the respective 125-volt loads. They should preferably be balanced as closely as is possible.

Fig. 3 shows the complete generator and switchboard connections for the parallel operation of two or more stabilized shunt wound (or straight shunt wound) three-wire d-c generators. On some generators the neutral connection is brought out from a balancing winding located within the armature by means of brushes in contact with a single slip ring. Other types will have two slip rings, in which case the stationary separately-mounted balancing coil (having the appearance of a transformer) will be connected across the two rings. Its mid-tap becomes the neutral lead.

It will also be noted that two-wire stabilized shunt wound generators have but one interpole field and but one stabilizing field, these being connected in series on the negative side of the armature; whereas on three-wire generators the interpole field and the stabilizing field are both split into two sections, half of each being connected on either side of the armature.

Fig. 4 shows the complete generator and switchboard connections for the parallel operation of two or more compound wound three-wire d-c generators. Note that two equalizer connections are obtained at the board, requiring seven heavy cables between generator and board and use of two equalizer buses

The procedure for making required paralleling adjustments follows:

1. Using a 250-volt load, connected across the plus and minus mains with only the neutral being unused, make all tests and adjustments as required for a corresponding two-wire machine and for the same reasons. As there are now two series fields, each must be individually adjusted to give the desired exactly identical compounding on both sides of the armature. Half-voltage readings will be obtained between the main lead of the series field under adjustment, and the neutral connection.

2. The resistance of each series circuit must now be adjusted to be exactly alike. This is determined by checking the full-load voltage drop between each main and its equalizer connection. Resistance will be inserted (as previously discussed) in the main lead of the series circuit having the lower voltage drop until the two are exactly alike. Similar adjustments must be made to unit No. 2 (and all additional units which will be paralleled). All units must have the same compounding from no-load to full-load and the resistance of all series circuits must be exactly alike.

3. After the units have been individually adjusted to have like characteristics, unit No. 2 can be put on the board in parallel with No. 1 which is assumed already to be carrying load by proceeding as follows:

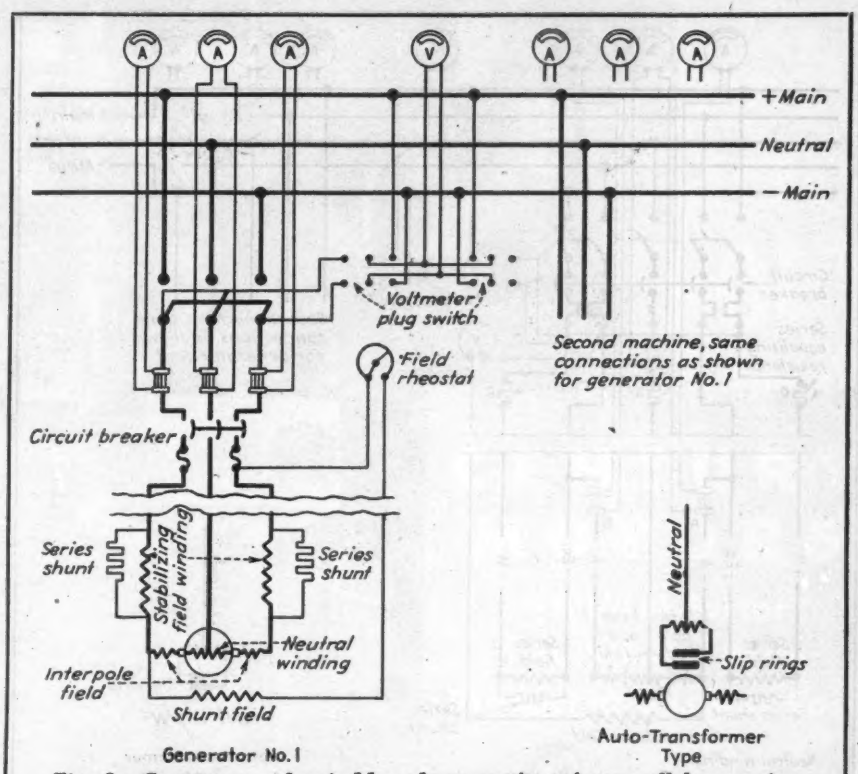


Fig. 3—Generator and switchboard connections for parallel operation of two stabilized shuntwound interpole three-wire generators. Generator No. 1 is shown with an internal balancing winding with neutral brought out on one slip ring. At lower right is diagram of auto-transformer type external balancing unit requiring two sliprings on generator shaft.

a. See that No. 2 machine circuit breaker and all switches are open and all rheostat resistance cut in.

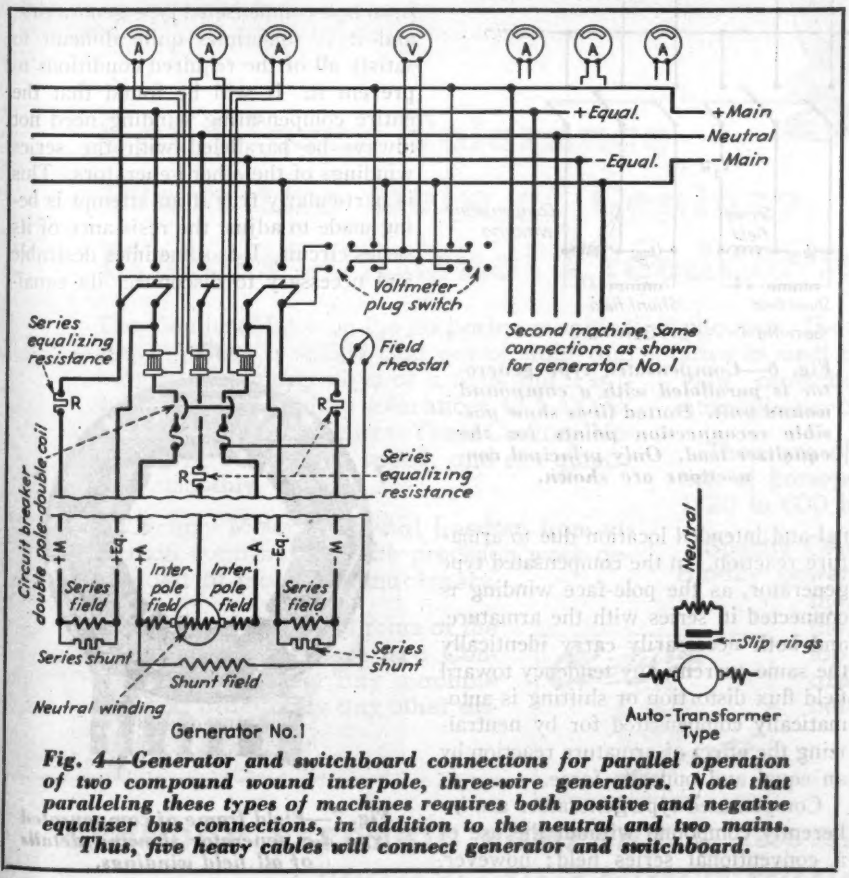


Fig. 4—Generator and switchboard connections for parallel operation of two compound wound interpole, three-wire generators. Note that paralleling these types of machines requires both positive and negative equalizer bus connections, in addition to the neutral and two mains. Thus, five heavy cables will connect generator and switchboard.

b. Bring No. 2 up to rated speed.

c. When rated speed is reached, close the circuit breaker.

d. Adjust rheostat slowly until generator voltage is equal to line voltage (which is the bus voltage as read by the switchboard meter of No. 1 machine) or slightly higher.

e. Close both main switches; then close the neutral switch.

f. Adjust field rheostat slightly to make No. 2 unit take its proper share of the load.

The purpose of the resistor R shown in series with the neutral lead is to provide a means of adjusting the proportionate unbalanced neutral current to be carried by each unit.

As an alternate to the connections as shown in Fig. 4 wherein the ammeter shunts are mounted at the board, it is to be noted that sometimes the shunts are mounted at the generator. In this case, the number of heavy leads from generator to board will be reduced from seven to only five leads. (Fig. 5.)

Compensated Type Generators

Compensated type generators are particularly well suited for handling sudden and very heavy load swings with excellent commutation; their capabilities in this respect are considerably better than conventional type machines. They have the usual shunt field, and

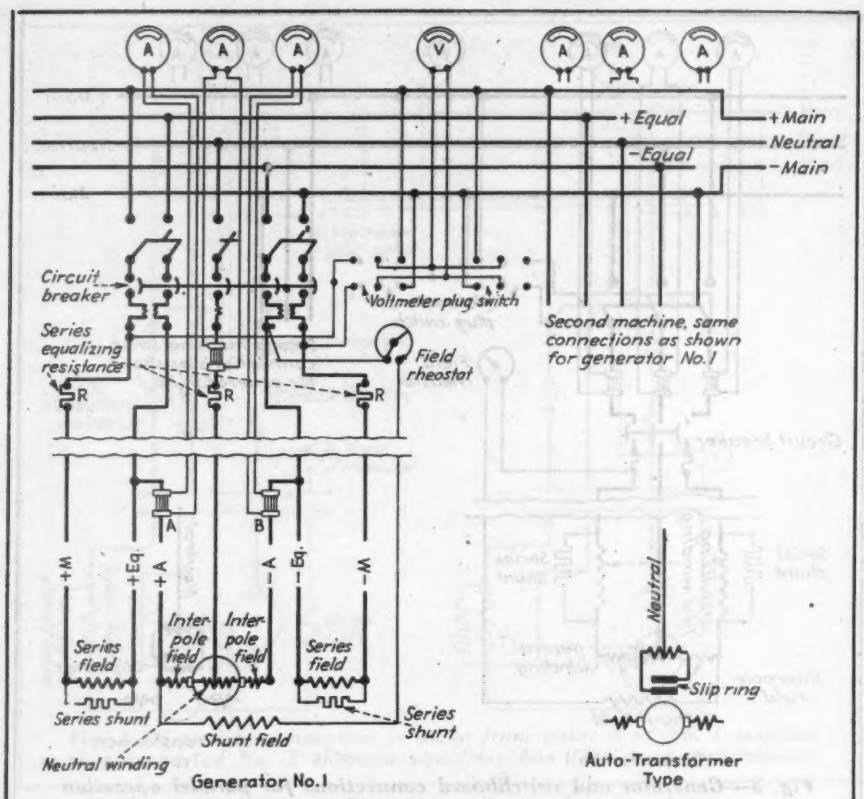


Fig. 5—Generator and switchboard connections for parallel operation of two compound wound interpole, three-wire generators. Ammeter shunts "A" and "B" are mounted at the machine. This reduces the number of heavy cables, connecting generator and switchboard, from seven to five.

interpole field as used in machines of conventional construction, but differ in that they are equipped with an additional heavy series winding which is carried by the main poles and which is connected in series with the interpoles and the armature. It may consist of several, rectangular-shaped, heavy solid copper bar conductors per pole, running horizontally through the main pole faces with suitable series connections from pole to pole; or, as some manufacturers prefer, the entire pole face or compensating winding is made from laminated copper ribbon.

Compensated generators, in general, have extremely low resistance series circuits as compared to conventional non-compensated machines. And yet, while it is not particularly difficult to parallel two or more similar compensated machines, it is frequently extremely difficult to satisfactorily parallel a compensated type generator with a conventional non-compensated unit. The reason for this is that the compensated unit will have a decided tendency to grab the whole load in spite of the usual adjustments.

Compensating Action

In the conventional type generator, an increase in load tends to distort or shift the main field flux from its original and intended location due to armature reaction. In the compensated type generator, as the pole-face winding is connected in series with the armature, and both necessarily carry identically the same current, any tendency toward field flux distortion or shifting is automatically compensated for by neutralizing the effect of armature reaction by an equal and opposite force.

Compensated type generators are inherently compound without the use of a conventional series field; however, in infrequent instances, series fields are also included for special purposes.

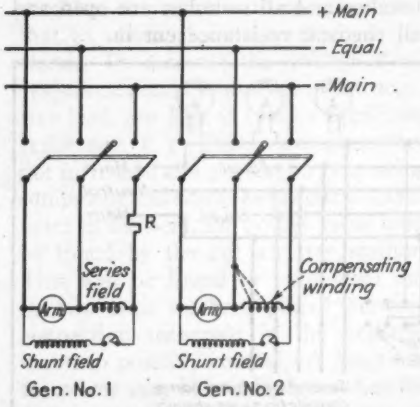


Fig. 6—Compensated type generator is paralleled with a compound wound unit. Dotted lines show possible reconnection points for the equalizer lead. Only principal connections are shown.

The connections used for paralleling two or more compensated generators, or for paralleling a non-compensated generator with a compensated unit, are exactly as shown in Fig. 2 for compound wound generators.

The same requirements likewise maintain; that is, all units must be adjusted to have the same voltage regulation from no-load to full-load and exactly the same resistance in their respective series circuits; otherwise excellent load division will not be obtainable.

Although it is entirely proper to use adjustable shunts across the series field of a conventional type generator, no shunt of any magnitude should be placed across the compensating winding of a compensated type generator to decrease its compounding. This would be likely to upset the balance between the armature current and that in the compensating winding to such an extent as to adversely affect commutation. An adjustment of the prime-mover governor to give a slightly greater speed droop from no-load to full-load would be preferable.

Compensated Units May Hog Load

Compensated generators inherently have a powerful paralleling tendency and generally tend to hog the load away from non-compensated type generators; and it is sometimes quite difficult to satisfy all of the required conditions to prevent it. It will be found that the entire compensating winding need not always be paralleled with the series windings of the other generators. This is particularly true if an attempt is being made to adjust the resistance of its series circuit. It is sometimes desirable and necessary to disconnect its equal-

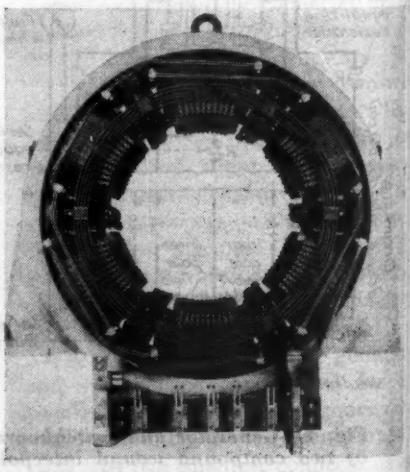
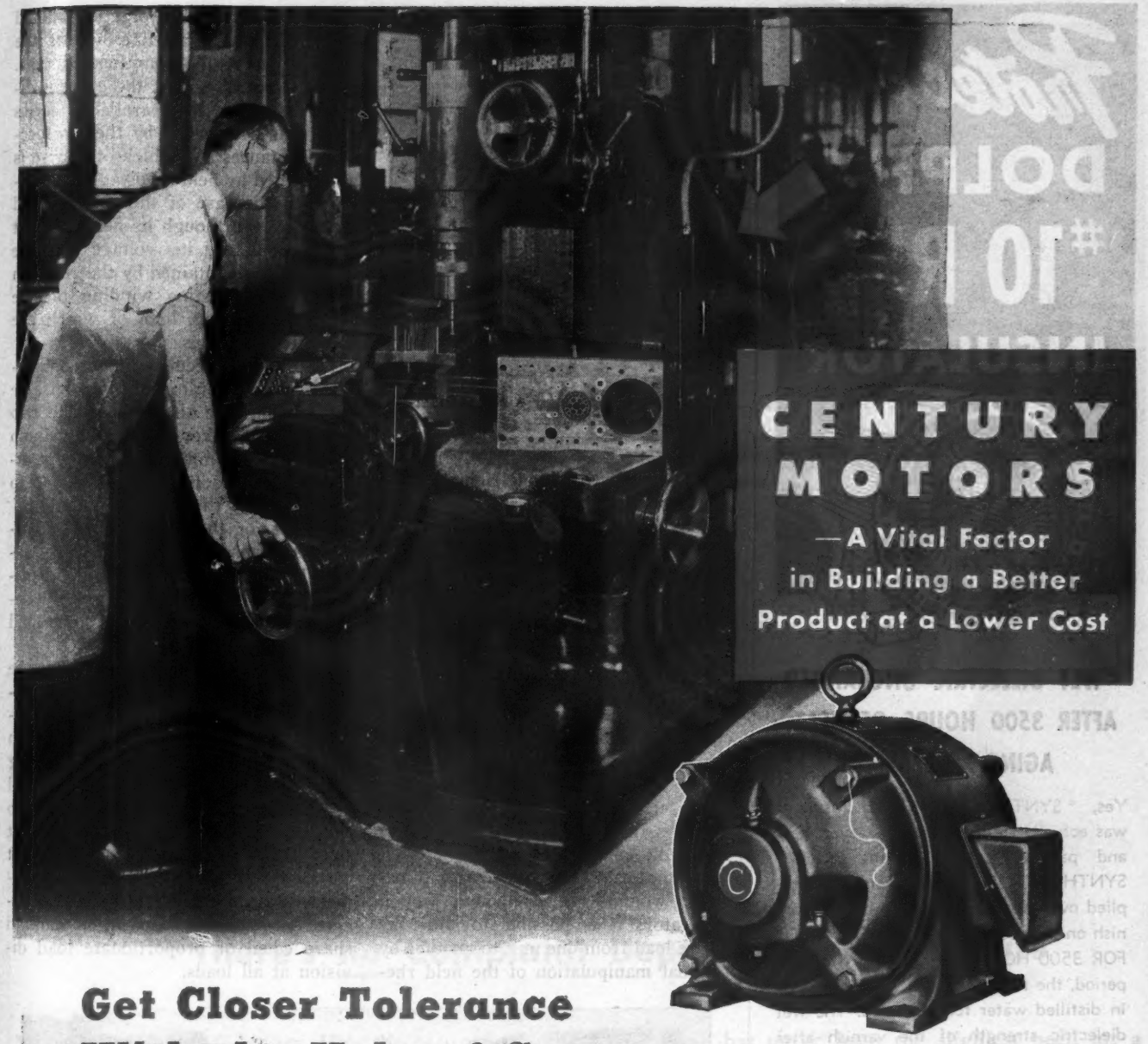


Fig. 7—Field frame of compensated type d-c generator showing details of all field windings.



Get Closer Tolerance With the Help of Century Motors' Unusual Freedom from Vibration

The Century Motor on the jig boring machine shown above is inside and out of sight and forgotten for many days at a time, but it is a vital factor in holding tolerances to ± .0002" on tools, jigs, and fixtures. These Century Motors start, come up to speed, and run quietly and smoothly.

Century Motors' unusual freedom from vibration contributes to the precision work demanded of tool room machinery.

Whether for the tool room or the production shop, there is a Century Motor to meet any machine tool and practically any other application. There is a wide range of types and sizes to meet the power demands and to provide protection against the surrounding atmospheric conditions.

They are offered in almost any combination of horsepower ratings and frames from 1/20 to 600 horsepower.

Specify Century Motors on all your electrically powered equipment. Engineered to the functional characteristics of the machines they drive to assure top performance—Century Motors are a vital factor in building a better product at a lower cost.

425

Century C MOTORS

CENTURY ELECTRIC COMPANY • 1806 Pine Street • St. Louis 3, Missouri

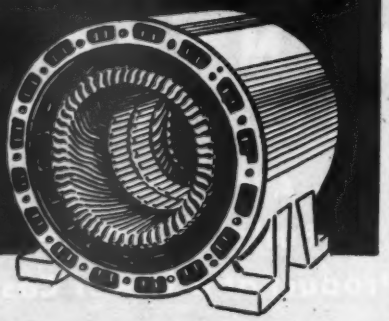
Offices and Stock Points in Principal Cities

Protection

DOLPH'S

#10 RED

INSULATOR



"WET DIELECTRIC UNCHANGED AFTER 3500 HOURS OF HEAT-AGING AT 275°F."

Yes, * SYNTHITE # 10 Red Insulator was actually subjected to this severe test and passed it with "flying colors." SYNTHITE # 10 Red Insulator was applied over two coats of clear baking varnish on a brass surface; and HEAT-AGED FOR 3500 HOURS AT 275°F. After this period, the test specimens were immersed in distilled water for 24 hours. The wet dielectric strength of the varnish after undergoing this treatment did not vary materially from the wet dielectric determined before the test, and the varnish film was still in good condition.

- ★ High Dielectric Strength
- ★ Excellent hiding power and coverage
- ★ High Arc Resistance
- ★ Fast Air Drying
- ★ Tough, Glossy Film
- ★ Distinctive Color
- ★ Easy Application
- ★ Adaptable to both interior and exterior use

* Reg. U. S. Pat. Off.

Insulating Varnish Specialists

Dolph's

JOHN C. DOLPH COMPANY

168 EMMETT ST., NEWARK 5, N. J.

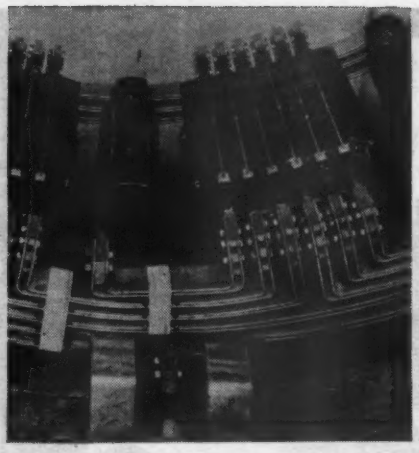


Fig. 8—Close-up of a compensating pole-face winding construction of poles and winding connections.

izer cable from the equalizer terminal on the generator and to reconnect same to some intermediate point on the compensating winding.

This point can readily be located by connecting a heavy jumper between the end of the equalizer cable and a selected point on the compensating winding; however, do not progress further than half-way (or but slightly more) around the frame from the original standard equalizer terminal or poor commutation will probably result. Fig. 6 illustrates the possible relocation of the equalizer lead to some intermediate point on the compensating winding as referred to above.

In the case of both conventional shunt wound and compound wound generators it is possible to shift the entire load from one unit to another by gradual manipulation of the field rheostats; however, this practice should not be attempted when either of the machines is of the compensated type. It will be recalled that the current division between the paralleled series circuits is determined by their respective resistances and which of course is not affected by field rheostat manipulation. In the case of the compensated machine, even though its field rheostat be manipulated, its voltage will be appreciably maintained by the reaction of the compensating winding on the armature winding, both of which are connected in series.

Due to this peculiarity of compensated type generators it is advisable when taking one off the board, to trip the circuit breaker and thereby dump its entire load immediately without attempting to gradually shift its load to other units by rheostat manipulation.

Except for the foregoing peculiarities, compensated generators are adjusted for parallel operation in identically the same way as previously described for conventional compound wound machines.

Occasionally generators will be found to have a humped voltage characteristic, wherein, instead of the voltage increase being in strict proportion to the load, most of the compounding might occur at some fractional load point. Although it will be possible to parallel machines having different shaped load characteristic curves at certain points on the curve by adjustment, it is impossible to make any adjustment by which they can be made to share equal or proportionate load division at all loads.

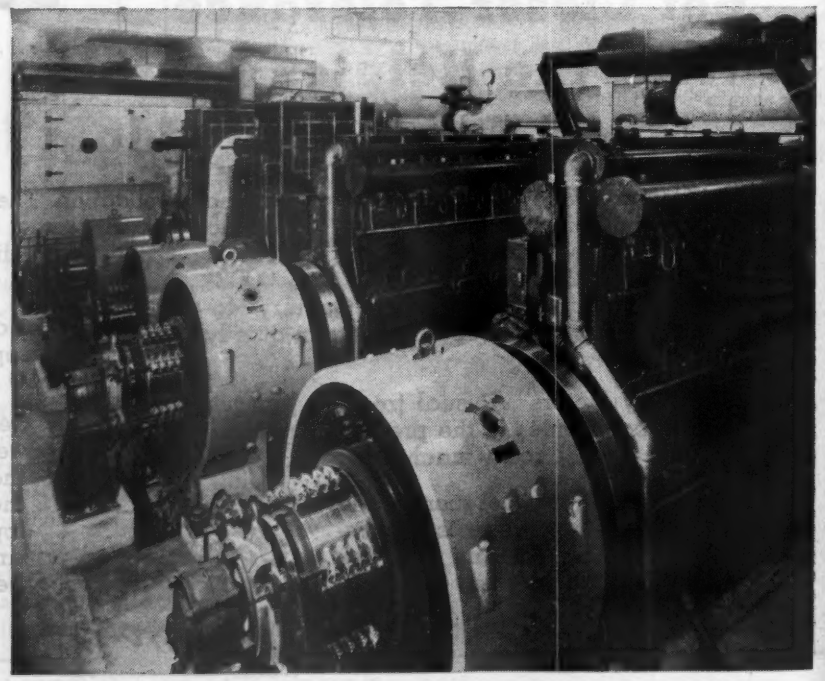


Fig. 9—Operating in parallel are these four, 150 kw. compound wound, three-wire, d-c generators in the Empire Trust Building, New York City. Two are steam driven and two are diesel driven.

THANKS TO *Mac* AND *Jack*—

There's no Complaint Department at Paranite

YOU'VE MET MAC before. He's the man who has grown up with this organization, and knows every detail of production so thoroughly that it is practically impossible to stump him on any question about electrical wires and cables. He's the man who has made "*Mac*simum" a common word around PARANITE.

You should know Jack, too. He's the electrical-chemical engineer who "lives" in the laboratory—supervising rigid testing of all wires and cables in production—constantly experimenting with all forms of insulating materials—developing special insulation to meet particular requirements in the field—carrying on extensive research for the betterment of all PARANITE products.

Working together, Mac and Jack combine all the advantages of long experience and sound judgment with scientific knowledge and creative ability. That's why there has never been the slightest need for a Complaint Department at PARANITE.

Wholesalers, everywhere, sell PARANITE *with confidence;* architects, builders, contractors, engineers, manufacturers, accept PARANITE *with confidence.* They know...

If it's PARANITE it's right!

PARANITE
WIRE AND CABLE
Division of
ESSEX WIRE CORPORATION
Fort Wayne 6, Indiana

ELECTRICAL WIRES AND CABLES *"BETTER THAN CODE REQUIRES"*

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

S-3

NEMA Standard Terminal Markings and Connections—III

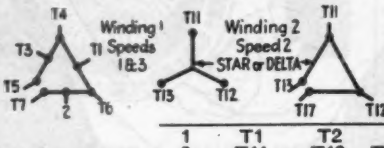
CONSTANT HORSEPOWER, RECONNECTED WINDING

FIG. 13—TWO SPEED, SINGLE WINDING

Speed	Connect Lines L1 To Motor Terminals	L2	L3	Connect Together
1	T1	T2	T3	T6 T4, T5
2	T6	T4	T5	.....

Typical Speeds 600, 1200

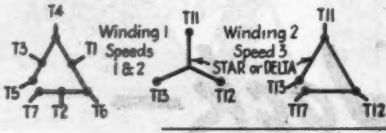
FIG. 14—THREE SPEED, TWO WINDING



Alternate (1-2-1) Arrangement. Typical Speeds 600, 900, 1200.

1	T1	T2	T3	T4, T5, T6, T7
2	T11	T12	T13, T17	.....
3	T6	T4	T5, T7	.....

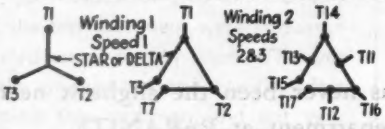
FIG. 15—THREE SPEED, TWO WINDING



Tandem (1-1-2) Arrangement. Typical Speeds 600, 1200, 1800.

1	T1	T2	T3	T4, T5, T6, T7
2	T6	T4	T5, T7	.....
3	T11	T12	T13, T17	.....

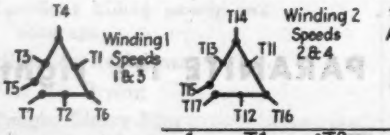
FIG. 16—THREE SPEED, TWO WINDING



Tandem (1-2-2) Arrangement. Typical Speeds 600, 900, 1800.

1	T1	T2	T3, T7	.....
2	T11	T12	T13	T14, T15, T16, T17
3	T16	T14	T15, T17	.....

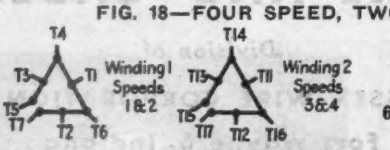
FIG. 17—FOUR SPEED, TWO WINDING



Alternate (1-2-1-2) Arrangement. Typical Speeds 600, 900, 1200, 1800.

1	T1	T2	T3	T4, T5, T6, T7
2	T11	T12	T13	T14, T15, T16, T17
3	T6	T4	T5, T7	.....
4	T16	T14	T15, T17	.....

FIG. 18—FOUR SPEED, TWO WINDING

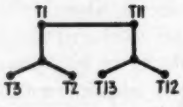


Tandem (1-1-2-2) Arrangement. Typical Speeds 600, 1200, 1800, 3600.

1	T1	T2	T3	T4, T5, T6, T7
2	T6	T4	T5, T7	.....
3	T11	T12	T13	T14, T15, T16, T17
4	T16	T14	T15, T17	.....

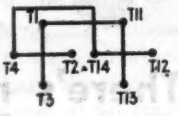
SEPARATE WINDING TYPES

FIG. 19—TWO SPEED, TWO WINDING, THREE PHASE



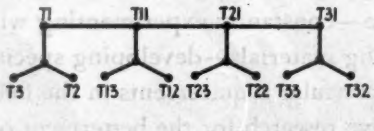
Speed	Connect Lines L1 To Motor Terminals	L2	L3
1	T1	T2	T3
2	T11	T12	T13

FIG. 20—TWO SPEED, TWO WINDING, TWO PHASE, FOUR WIRE



Speed	Connect Lines L1 To Motor Terminals	L2	L3	L4
1	T1	T2	T3	T4
2	T11	T12	T13	T14

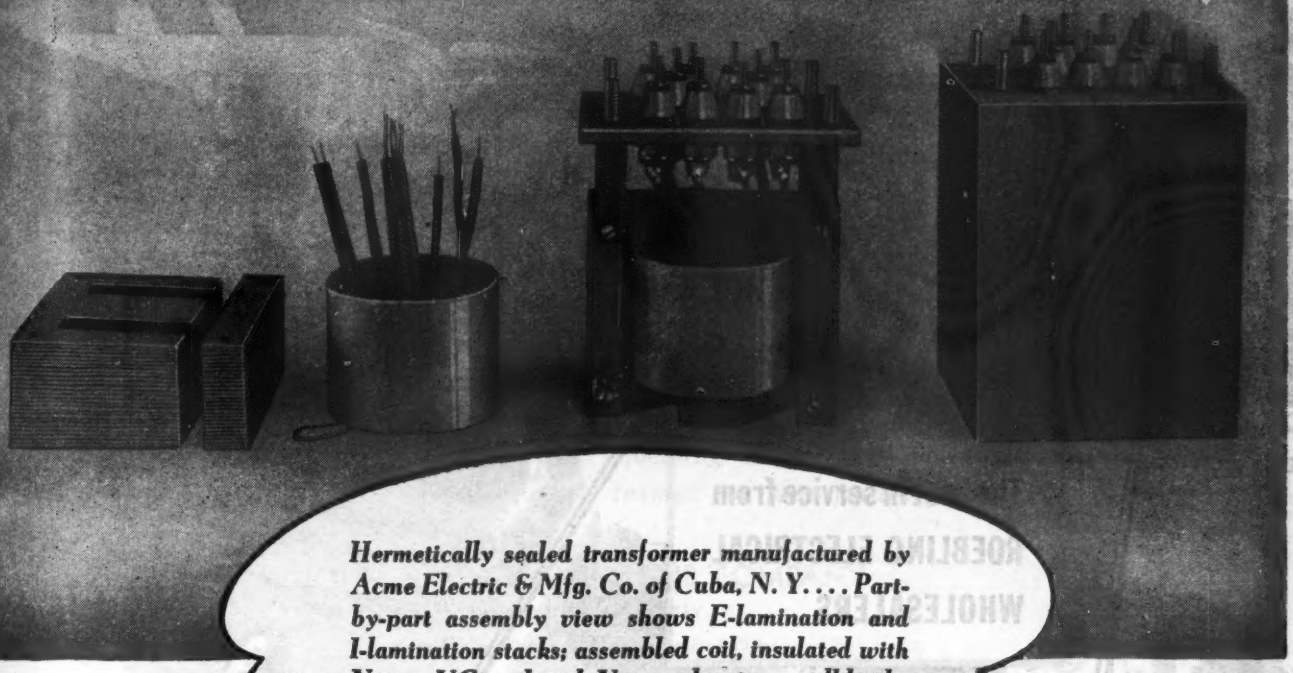
FIG. 21—FOUR SPEED, FOUR WINDING, THREE PHASE



Speed	Connect Lines L1 To Motor Terminals	L2	L3
1	T1	T2	T3
2	T11	T12	T13
3	T21	T22	T23
4	T31	T32	T33

Information from Cutler-Hammer, Inc.

Hermetic Sealing Demands Top-Quality Components



Hermetically sealed transformer manufactured by Acme Electric & Mfg. Co. of Cuba, N. Y. . . . Part-by-part assembly view shows E-lamination and I-lamination stacks; assembled coil, insulated with Natvar VC, and with Natvar sleeving on all leads; complete chassis; and completed transformer in hermetically sealed case.

Acme builds transformers to pass the rigid Navy 5 cycle immersion test for hermetically sealed units. Because they are used on important equipment for the Armed Forces, it is essential that quality material be used throughout. *These transformers dare not fail!*

And so every precaution is taken to see that the internal components are far above the standards acceptable for ordinary service. Natvar VC and Natvar sleeving are used because they consistently meet the requirements.

What about *your* requirements? Write, wire or phone us for deliveries, either from nearby wholesaler's stock, or from our own.

Natvar

- Varnished cambric — straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished cellulose acetate
- Varnished special rayon
- Varnished Fiberglas cloth
- Varnished papers
- Varnished tubings and sleeving
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing
- Extruded vinyl identification markers

Write for Catalog No. 20

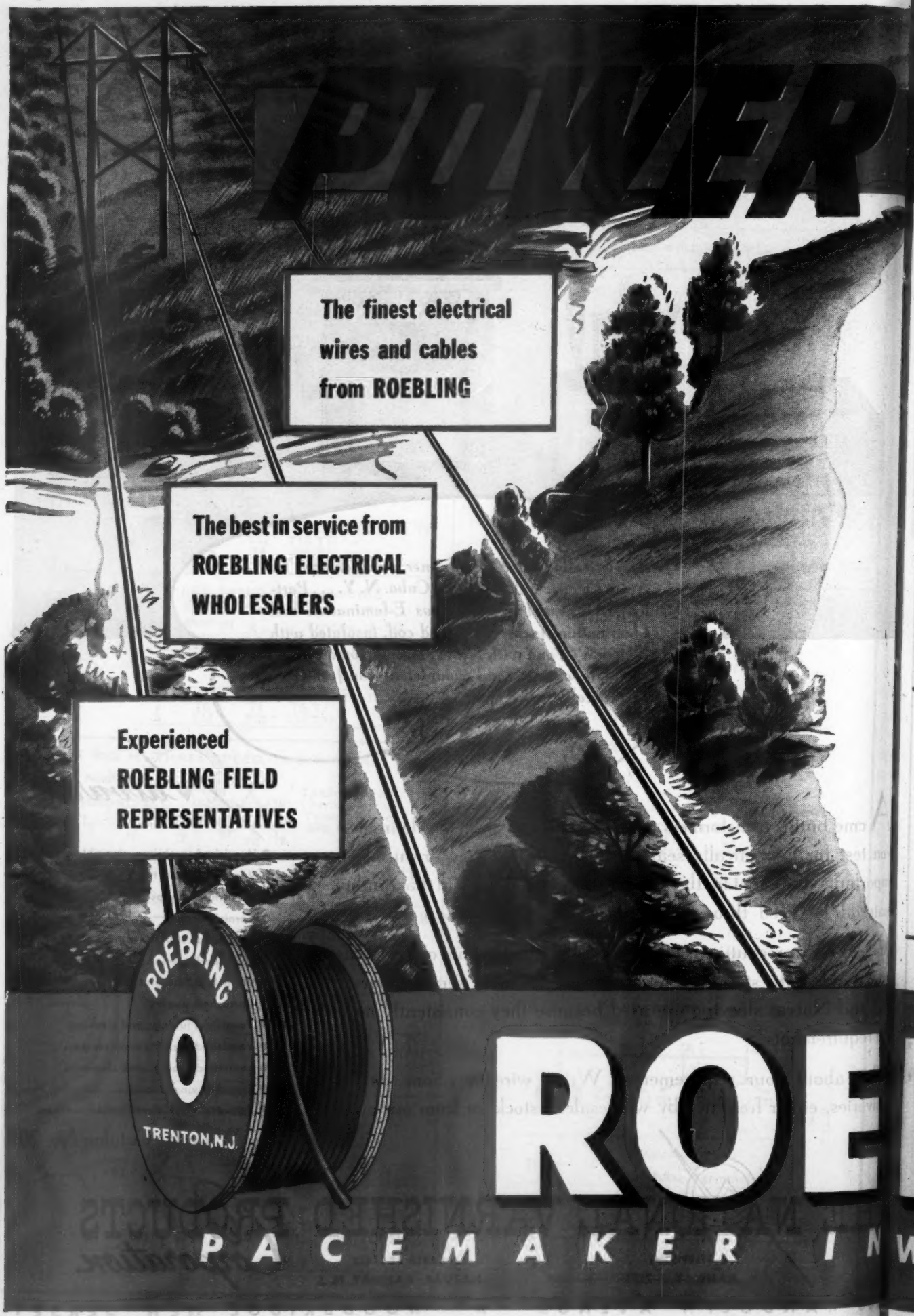
THE NATIONAL VARNISHED PRODUCTS Corporation

TELEPHONE
RAHWAY 7-2171

CABLE ADDRESS
NATVAR: RAHWAY, N. J.

205 RANDOLPH AVENUE ★ WOODBRIDGE NEW JERSEY

7-NVP-3


POWER
The finest electrical wires and cables from ROEBLING
The best in service from ROEBLING ELECTRICAL WHOLESALERS
Experienced ROEBLING FIELD REPRESENTATIVES
ROEBLING
TRENTON, N.J.
ROE
PACEMAKER

TO HELP YOU DO A BETTER JOB

WHEN TOMORROW'S COMPETITION SETS IN

HERE'S YOUR THREE LINE SYSTEM to give you extra power when the going gets tough. With tomorrow's competition—you'll need more than quality equipment alone. You'll need the best in service, too. And you'll get it from Roebling Electrical Wholesalers . . . Roebling Field Representatives: *when you need it . . . where you need it . . . and at the right price.*

We're doing our part today to see that you get Roebling wire and cable that embodies every modern development—made of the finest materials available.

To meet tomorrow's competition—look to Roebling quality products and service . . . Roebling Electrical Wholesalers. *They're teamed for your future profits.*

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

ROEBLING ELECTRICAL WIRES AND CABLES

WEATHERPROOF WIRE • SERVICE ENTRANCE CABLES • RUBBER COVERED WIRES AND CABLES (INCLUDING THIN-WALL INSULATED BUILDING WIRES AND CABLES) • RUBBER INSULATED POWER CABLES • PIGTAIL AND BRAIDED COPPER • TELEPHONE WIRES • RUBBER SHEATHED PORTABLE CABLES • BARE COPPER STRAND • MAGNET WIRE • VARNISHED CAMBRIC POWER CABLES • TROLLEY CONTACT WIRE

BLING

JR ROEBLING

WIRE PRODUCTS

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

S-4

Suggested Symbols for Electrical Drawings—I

As a general rule, engineers seem to have their own ideas of symbols for electrical drawings—a carryover of specific practices in drafting rooms where they were formerly employed. The net result, when one or more of these engineers is working on related drawings, is an unwarranted confusion. The remedy has been to adopt one set of symbols and change all drawings to agree.

The suggested symbols for electrical drawings outlined in this and succeeding data sheets have been compiled and adopted by the H. E. Beyster Corporation, Architects and Engineers, Detroit, Michigan, as a standard for use in making electrical plans; and as a standard guide for each electrical designer.

These symbols are representative of the standards adopted by the A.I.E.E., A.I.A., and I.E.S. They are segregated as to ceiling, wall or floor outlet locations. They are for use on architectural plans which pertain to illumination, small mechanical equipment motors, communication, auxiliary equipment, etc., as generally used in factory, office, department stores, residences and other related types of buildings.

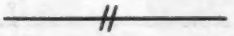
SYMBOLS FOR CIRCUITS

Underfloor duct and junction box — triple system — for double or single system eliminate one or two lines

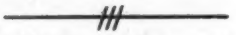
Branch circuit — run concealed under floor above

Branch circuit — run exposed

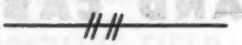
Branch circuit — run concealed under floor



Two wires in conduit

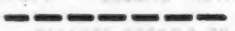


Three wires in conduit

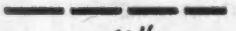


Four wires in conduit

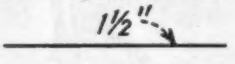
Feeder circuit — run concealed under floor above



Feeder circuit — run exposed



Feeder circuit — run concealed under floor



This notation at conduit run indicates pipe size

Conduit going up

Conduit going down

Indicates home run to lighting panel—1 circuit

Indicates home run to lighting panel—2 circuits

L2B2 — *This notation at home run outlet or panelboard denotes — Lighting panelboard on second floor at or near intersection of Column B and 2*

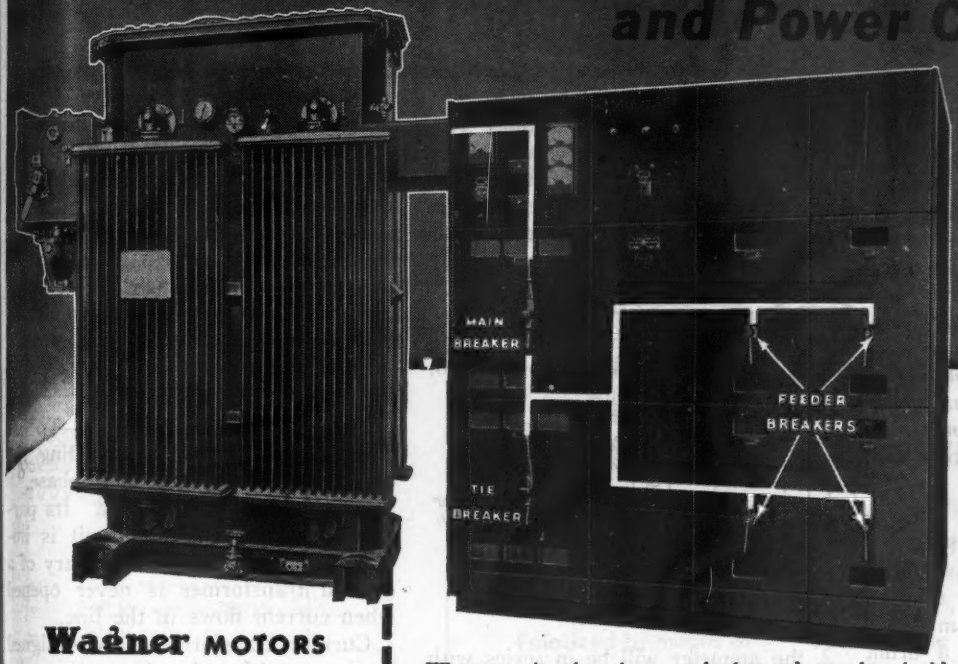
P3A4 — *This notation at home run outlet or panelboard denotes — Power panelboard on third floor at or near intersection of Column lines A and 4*

N.I.C. — *Not in contract*

Information from L. W. Saltz, H. E. Beyster Corp., Detroit.

Wagner
UNIT SUBSTATIONS

Provide Load Center Control for Lighting and Power Circuits...



Check THESE ADVANTAGES

Wagner unit substations can be located any place inside or outside your plant thus making it possible for you to determine the location of the load center placing it near the heavy load areas or power-using centers. Wagner unit substations combine one or more step-down transformers with the necessary load center for controlling the distribution power-circuits.

1. Saving of copper in connecting cables. Locating the transformer near the load allows the use of shorter and smaller cables over a great part of the distance the power must travel.

2. Improves performance of motors and lights. Inherent linedrop is avoided by eliminating long low-voltage feeders.

3. Can be installed indoors without the use of extensive fireproof vaults. The entire substation may be located on the floor in the open, saving construction time and material.

4. Simplifies installation. Complete substation is shipped in one or more factory-assembled units, completely wired, ready for installation and final connection.

5. Provides flexibility to meet future conditions. Compartments in the load centers are of such dimensions that interchangeable breakers of different interrupting ratings can be substituted should plant modifications bring about changes in feeder loads.

6. Low maintenance expense. The complete enclosing of the buses and other equipment practically eliminates cleaning and dust problems and assures safety against contact with live parts.

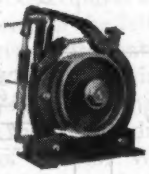
Illustrated above is a 1000-kva, 13,200-to 480-volt, 3-phase transformer with a two-position liquid-filled disconnecting switch on high-voltage side, key-interlocked with low-voltage breaker. The low-voltage side is equipped with air-break circuit-breakers manually operated, ground-indication lights, voltmeters, ammeters, ammeter switch, and test-blocks. Unit has one main breaker, one tie breaker, and four feeder breakers.

T45-17

Wagner MOTORS

There is a Wagner motor to fit every job. Our line is complete from small fractional-horsepower fan-type motors to large 400-horsepower motors used in heavy industries.

Wagner INDUSTRIAL HYDRAULIC BRAKES



Wagner Industrial Hydraulic Brakes are of two types: without parking brake (Type H) and with parking brake (Type HM). These braking systems provide quick, safe, smooth stops with the operator in complete and accurate control.

THESE BRANCHES ARE READY TO SERVE YOU

ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT HOUSTON • INDIANAPOLIS • KANSAS CITY LOS ANGELES • MEMPHIS • MILWAUKEE MINNEAPOLIS • NEW YORK • OMAHA PHILADELPHIA • PITTSBURGH • PORTLAND ST. LOUIS • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • SYRACUSE • TULSA WASHINGTON, D. C.

Each of these offices is manned by trained field engineers. They will gladly consult with you regarding your transformer, motor, and brake requirements.

Wagner Electric Corporation

ESTABLISHED 1891

6413 Plymouth Avenue, St. Louis 14, Mo., U. S. A.

In Canada: Wagner Electric at Leaside, Ontario

ELECTRICAL AND AUTOMOTIVE PRODUCTS

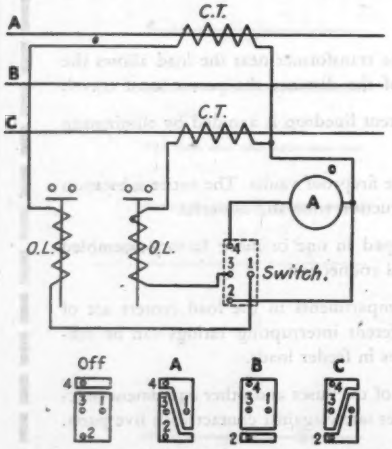
QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.

READER'S QUIZ

SELECTIVE READING OF PHASE CURRENT

QUESTION 180—The ammeter on our switchboard is connected to only one phase of our three phase system. The meter is now in series with one of the main overload relays which are connected to the two current transformers on the main bus. How can we reconnect this meter to read the load on the other two phases?—J. J. L.

A. TO QUESTION 180—There are a number of switching arrangements which may be used to achieve this result. The diagram shows one method which employs a drum type ammeter transfer switch which I have found to be a very rugged piece of equipment. This circuit maintains

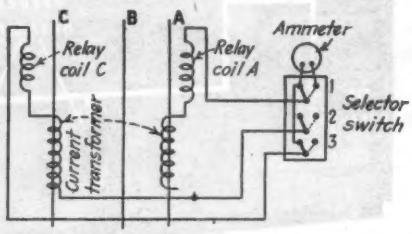


Drum development of ammeter transfer switch

overload protection at all times, permits a reading of all three phases and provides an "off" position for the meter.—S. P.

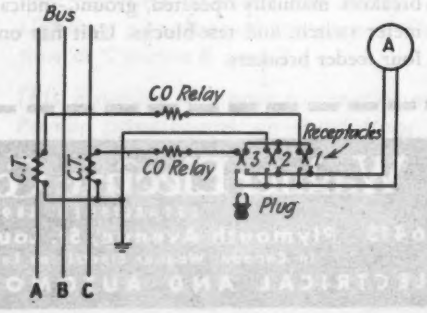
A. TO QUESTION 180—By connecting the transformer secondaries in open delta and using a selector switch, it will be possible to read the currents in all three phases of your system. Connections are shown in the following:

The selector switch is so constructed that *the transformer secondary circuits are not opened during switching operations.* With all switches closed as shown (solid line) the secondaries are short circuited. If the first switch is closed on contact No. 1, the ammeter will be in series with the phase A transformer secondary and will measure the current in that phase. If the second switch is closed on contact No.



2, the ammeter will be in series with the common connection of the transformer secondaries and will measure the current in phase B. If the third switch is closed on contact No. 3, the ammeter will be in series with the phase C transformer secondary and will indicate the current in that phase. The relay coils should be left in series as shown, so that their operation will not be affected.—J. E. W.

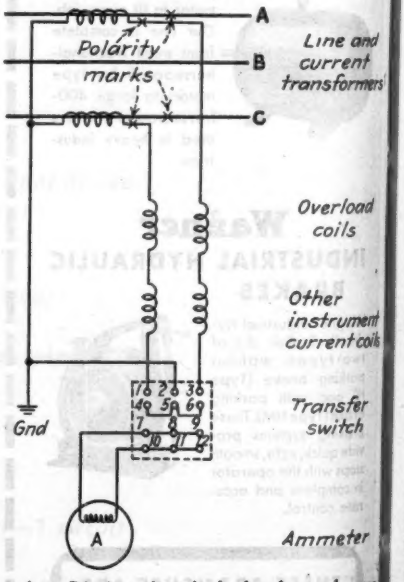
A. TO QUESTION 180—An ammeter plug switch with three receptacles and one plug or a rotary ammeter switch may be provided which will enable the operator to read the currents in any of the three phases. The plug switch connection is shown in the diagram. Inserting the plug in 1 and 3 will indicate the current in phases A and C, respectively. Plugging in 2 will result in an open delta connection for the secondaries of



the two current transformers in series with their respective overcurrent relay coils. Since the currents in the two secondaries are 120 degrees apart in phase, their resultant will be equal to the current in phase B. This connection eliminates the need of a third current transformer which would be used in phase B to measure its current. —R. G. C.

A. TO QUESTION 180—To use one ammeter for reading the current in more than one phase, a transfer switch is necessary. Its particular location in the circuit is immaterial as long as the secondary of a current transformer is never opened when current flows in the line.

Current transformers are designed to operate with a closed secondary cir-



cuit. If the circuit is broken, dangerously high voltages will result with damage to equipment and hazard to personnel.

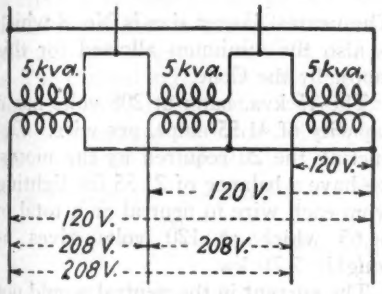
Three single-pole or one multi-pole ammeter transfer switches may be used. One leading manufacturer advocates the single pole switches because of their simplicity and freedom from contact troubles.

In the sketch, the transfer switch contacts 1 to 6 are connected to the transformers. Contacts 7 to 12 are

connected to the ammeter. When no reading is being taken, the following automatic cross connections are made at the switch: 1 to 4, 2 to 5, and 3 to 6. When taking a reading on Phase A, contact 1 is connected to 7 and 4 to 10 before the connection between 1 and 4 is opened. Connecting the instrument to 2 and 5 will give the vector sum of the currents flowing in Phases A and C.—L. E. B.

CALCULATING TRANSFORMER CAPACITY

QUESTION 181—I would like to run a branch circuit 300 feet to a 5 hp. motor rated three phase, 208 volts, 60 cycle. What size wire would be required and what is the formula for potential drop? With reference to the accompanying diagram, what would be



the current in each of the four wires, and how much line current capacity remains for a 120 volt lighting load?—W. F. M.

A. TO QUESTION 181—The N. E. Code gives 16 amps. as the rated full load current of a 5 hp., 3 phase, 208 volt motor. This current will be carried in each of the 3 phase wires and the current in the neutral will be zero. The Code requires a wire capacity of 125 percent of the full load motor current. This requires at least a No. 12 wire which has a rating of 20 amps. but a larger size may be necessary to reduce the voltage drop.

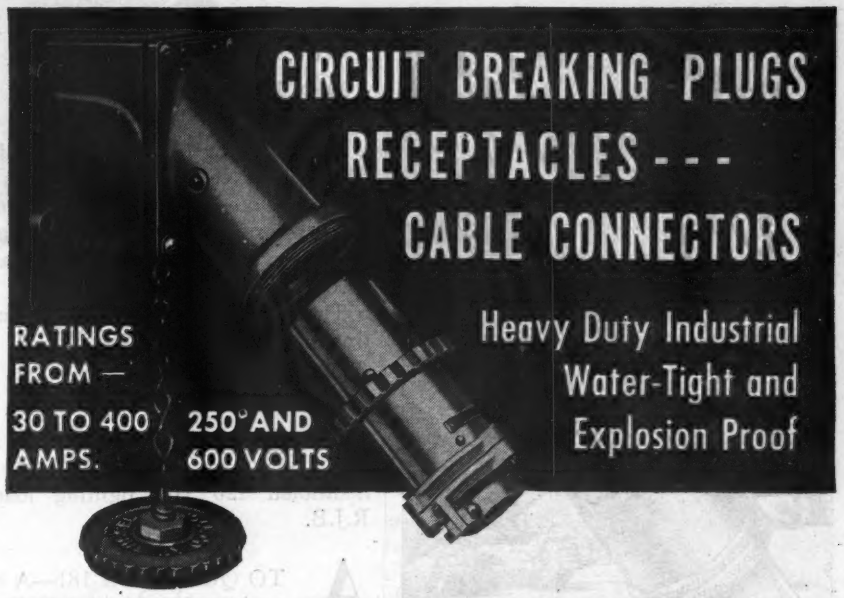
The Handbook of Interior Wiring Design gives a reliable set of curves for finding the voltage drop in 3 phase lines in conduit with copper temperature of 49 degree C. A 5 hp. motor has an approximate power factor of 85 percent and at this power factor the following voltage drops are given by the above mentioned curves:—(drops are phase to phase)

No. 12 wire—26.5 v. drop per 10,000 amp. ft.

No. 10 wire—17.0 v. drop per 10,000 amp. ft.

No. 8 wire—10.5 v. drop per 10,000 amp. ft.

No. 6 wire— 7.0 v. drop per 10,000 amp. ft.


CIRCUIT BREAKING PLUGS
RECEPTACLES - - -
CABLE CONNECTORS
RATINGS FROM — 30 TO 400 AMPS.
250° AND 600 VOLTS
Heavy Duty Industrial Water-Tight and Explosion Proof

ENGINEERED AND PRECISION BUILT—

FOR SAFE OPERATION

Positive grounding by means of housing and separate contact for safety circuit wire.

Polarized by means of contact arrangement and groove and key in housing. Impossible to insert plug incorrectly.

All contact surfaces are precision machined and adjusted for maximum contact pressure, reducing arcing to a minimum.

Arcing chamber is completely inclosed. Arc is extinguished before plug is completely removed.

FOR LOW MAINTENANCE

Contacts—free floating, self-wiping, stay clean and retain full contact pressure.

Sealed cable grip — no strain on connections. Excludes all dust and moisture.

Ground surfaces and durable oil-resistant gaskets.

Liberal space for wiring, quick and easy access. Facilitates inspection and servicing.

FOR EASE OF INSTALLATION

Substantial external lugs for easy mounting.

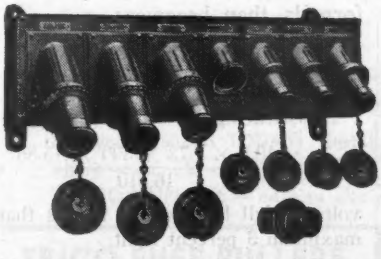
Boxes will accommodate a variety of conduit outlets to suit all job requirements.

Ample wiring space and substantial terminals make wiring easy.

Assembly of interior and contacts requires no special tools.

Interiors do not extend back of covers permits direct assembly to cabinets without internal interference.

A high degree of standardization and interchangeability of parts provides a wide variety of types and sizes to suit every requirement.



SEVEN GANG — Combination of different capacity receptacles.

ASK FOR THE 300 PAGE CATALOG

Since 1902

Please address Dept. No. A

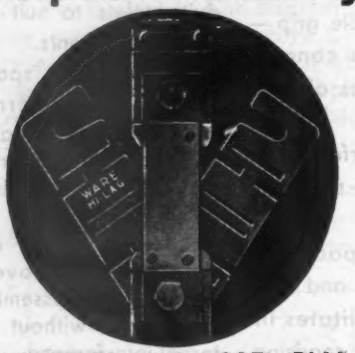
RUSSELL & STOLL COMPANY

EXPLOSION-PROOF, WATER-TIGHT, INDUSTRIAL LIGHTING FIXTURES AND EQUIPMENT. AUTOMATIC LOCKING "EVER-LOK" CONNECTORS

125 BARCLAY STREET · NEW YORK 7, N. Y.

32

WARE
HI-LAG
Keep Motors Humming



KNIFE-BLADE ASSEMBLY
For Low Contact Resistance
Non-Heating Wide Surface Areas
And Quick Link Renewal

ARMY E NAVY
100% Quality
APPROVED BY UNDERWRITERS
WARE BROTHERS
4410 W. Lake St. Chicago 24, Ill.

WARE
Renewable
HI-LAG FUSES

In this problem, therefore, for No. 12 wire, the drop is

$$\frac{300 \times 16}{10{,}000} \times 26.5 = 12.7 \text{ volts drop}$$

Similarly, for No. 10 wire the drop is 8.2 volts; No. 8 wire the drop is 5.0 volts; No. 6 wire the drop is 3.35 volts.

Therefore, No. 8 wire should be used since it will give approximately a 2½ percent voltage drop.

The full load current rating of each transformer is

$$\frac{5000 \text{ volt-amps}}{120 \text{ volts}} = 41.6 \text{ amps.}$$

This leaves 41.6 − 16.0 = 25.6 amps. per phase which is available for additional 120 volt lighting load.—R.J.B.

A. TO QUESTION 181—A convenient formula to determine the size wire required for a three phase circuit drop is:

$$CM = \frac{10.8 \times \sqrt{3} \times D \times I}{VD}$$

where D = distance one way
I = amperes
VD = volts drop

The 5 hp. 208 volt, 3 phase motor will take 15.85 amperes at full load. The N. E. Code requires the wire to be of sufficient size to carry 125 percent of full load or 19.8 amps. Assuming a 3 percent drop at 125 percent load, the total drop will be 6.2 volts.

Substituting in formula:

$$CM = \frac{10.8 \times 1.73 \times 300 \times 19.8}{6.2} = 17{,}900.$$

No. 8 is 16,510 CM and No. 6 is 26,250 CM. The Code gives No. 12 as the minimum size so either size is O.K. depending upon the actual voltage drop which can be tolerated.

If the line is to be run on poles, No. 8 is the smallest size that should be used for mechanical reasons.

Assuming you use No. 8, the drop in volts can be calculated by the same formula by transposing for VD. The formula then becomes:

$$VD = \frac{10.8 \times \sqrt{3} \times D \times I}{CM}$$

Substituting:

$$VD = \frac{10.8 \times 1.73 \times 300 \times 15.85}{16{,}510} = 5.4$$

volts at full load, which is less than the maximum 3 percent limit.

If the conductors are run inside or in conduit, No. 10 could be used in which case the drop would be 8.2 volts or 4 percent which is not too bad if power is reasonably cheap.

The total current per phase on a three phase 15 kva. bank is 41.7 amperes. The motor will require 15.8 amps. at full load, leaving 25.9 amps. per phase as the maximum current that should be drawn continuously from the transformers. This may be taken by motors connected to the phase wires or by the lights connected between the phase wires and the neutral.

The current in the neutral will vary from zero if the phases are balanced to 25.9 should all lights be out on one phase. The motor load does not affect the neutral.

As transformers are built to stand an overload of 50 percent for two hours, this extra capacity can be used and would give a maximum lighting load of 46.7 amps. per phase for a short period.—A.E.T.

A. TO QUESTION 181—The formula for three phase drop is:

$$CM = \frac{1.732 \times 10.8 \times 20 \times 300}{10.4} = 10{,}734$$

The nearest larger size is No. 8 which is also the minimum allowed for this motor by the Code.

The 15 kva. bank at 208 volts has a capacity of 41.55 amps. per wire. Deducting the 20 required by the motor, we have a balance of 21.55 for lighting from each wire to neutral or a total of 64.65 which at 120 volts gives us roughly 7.76 kw.

The current in the neutral would not exceed that of the "hot" wires and becomes zero when the load is balanced. —I.H.G.

A. TO QUESTION 181—It is assumed the motor draws 16 amp., being 6 percent greater than a 5 hp. motor at 220 volts as provided by the Code.

The Code requires No. 12 wire from the standpoint of heating. A No. 8 wire would be required to keep the voltage drop within the allowable 3 percent maximum. Therefore, No. 8 should be chosen.

Formula for potential drop is:

$$v = \sqrt{3} R I \cos\phi \left(1 + \frac{X}{R} \tan\phi\right)$$

where
v = line-to-line voltage difference between the ends of the circuit.
R = total resistance per conductor.
I = amperes per conductor.
ϕ = power factor angle between current and voltage.
X = total reactance per conductor.

Values for the various factors may be calculated from information given in standard electrical engineering handbooks. For No. 8 R.C. wires, "v" figures to 4.46 v. with the motor drawing the assumed current at 80 percent power factor.

With a balanced load, no current

flows in the neutral wire. The transformers have a rated output of 41 amp. at 120 volts. If the three line wires are at least No. 6 in size (required by Code for this current) the 41 amp. will be available for distribution in the circuit. Subtracting the 16 amp. drawn by the motor, leaves 25 amp. available for other balanced loads.—L.E.B.

A. TO QUESTION 181—From the Code, a 5 hp. motor at 208 volts, 3 phase, 60 cycles takes 15-9 amps per line, and would require at least a No. 12 R. C. conductor.

Using the following formula:

$$VD = \frac{R \times L \times \sqrt{3} \times I}{1000}$$

where VD = voltage drop
R = ohms per 1000 feet
L = length of run in feet
I = amperes

we will find that it is necessary to use a No. 8 R.C. which will give a drop of 2.45 percent which is O.K. for a power circuit.

The current in the wires at the transformers due to the motor load is 15.9 amps. on each of the three 208 volt legs and zero in the neutral.

The current per phase leg is

$$\frac{\text{kva}}{\text{volts}} = \frac{5000}{120} = 41.6 \text{ amps.}$$

The remaining capacity per phase wire is 41.6 — 15.9 = 25.7 amps., which may be used for the lighting load. If the lighting load is perfectly balanced the neutral will still carry no load. The neutral will carry only the unbalanced portion of the load which in this case would have a maximum of 25.7 amps.—J.N.R.

A. TO QUESTION 181—Assuming an efficiency of 80 percent and a power factor of 82 percent, the line current of the five horsepower 208 volt, 60 cycle, three-phase motor will be:

$$I = \frac{5 \times 746}{1.73 \times 208 \times .80 \times .82} = 15.8 \text{ amps.}$$

Allowing a 3 percent voltage drop in the line and a possible overload of 25 percent, the cross-section of each wire will be:

$$CM = \frac{10.8 \times 1.73 \times 1.25 \times \text{line current} \times \text{cable length}}{\text{percent voltage drop} \times \text{line voltage}}$$

$$= \frac{10.8 \times 1.73 \times 1.25 \times 15.8 \times 300}{.03 \times 208}$$

= 17,800 circular mils

No. 8 wire has 16,510 circular mils and No. 6 has 26,250 CM. No. 6 wire is therefore chosen unless a higher voltage drop is permissible.

The formula for the potential drop in a three-phase line is:

Completely Machined Bars

Catalogue

76 pages . . . lists and describes the most complete bearing service in the world. Write for your free copy.

● You save three ways when you buy Johnson UNIVERSAL Bronze Bars. You save time because every bar is completely machined . . . I. D. . . . O. D. . . . Ends. This eliminates all the *extra* work in your shop. You save money because UNIVERSAL bars weigh 25% less than rough bronze. You save bother because reasonably good stocks of more than 350 sizes are maintained in all industrial centers. Why not try UNIVERSAL on your next job?

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
490 S. MILL STREET NEW CASTLE, PA.

TRICO
KLIPLOK CLAMPS FOR FUSE CLIPS

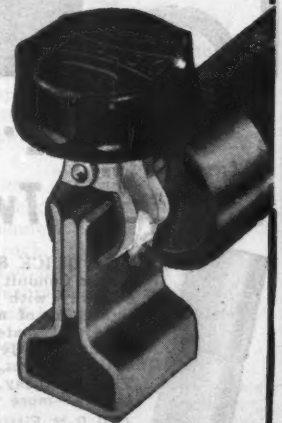
SAVE FUSES-CLIPS-POWER

Note how that jack-screw pressure literally bolts the fuse and clip together!

KLIPLOKS ELIMINATE

- Destroying temperatures
- Burnt fuses and clips
- Arcing at contacts
- Wasted current
- Unnecessary shutdowns
- Night and holiday repairs

End your troubles TODAY! Install KLIPLOKS everywhere — on old and new clips. Be sure to say: "TRICO KLIPLOKS — nothing else will do."



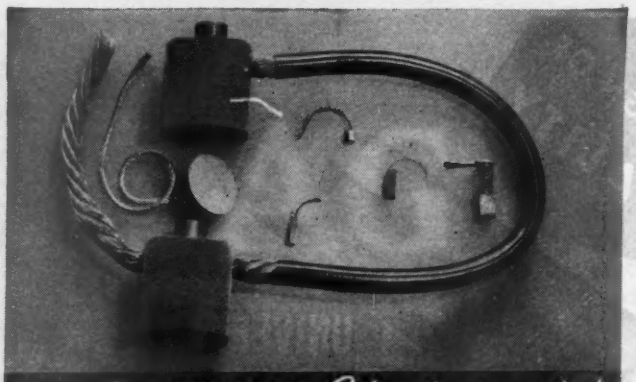
There's a size to fit both ferrule and knife blade types fuse clips

TRICO FUSE PULLERS

- Every electrician should carry one.
- Hang one at every switchboard.
- Place one in each tool kit.
- Every fuse box should have one.

They're cheap insurance against unnecessary accidents.

TRICO FUSE MFG. CO. Milwaukee 12, Wis.
In Canada—IRVING SMITH LIMITED—Montreal



SUPERIOR *Silver-Impregnated* CARBON BRUSHES

We'll Prescribe....

TO MEET YOUR NEEDS

Increasingly severe operating conditions are continually creating new demands in respect to commutation, current density, speed, low voltage, non-oxidization, and endurance. For such requirements investigate Superior Carbon Brushes impregnated with silver. Our Research Department is at your command.

SUPERIOR CARBON PRODUCTS, INC.
9113 GEORGE AVENUE · CLEVELAND 5, OHIO

"Since 1919" **SUPERIOR** CARBON BRUSHES

Cross section Showing Indentations.

E·M·T·UP THE QUICK WAY
Two Squeezes and it's Set

TWO QUICK SQUEEZES give you Finer, Faster Conduit Connections. B-M Fittings do away with the twisting, turning and tightening of nuts and save you valuable time and materials. Then too, they are stronger, neater and much easier to work with in tight places. Start using B-M Fittings today. Have more satisfied customers—more profits from each job!

(All B-M Fittings carry the Underwriters Seal of Approval)

DISTRIBUTED BY

The M. B. Austin Co., Chicago, Ill.
Clayton Mark & Co., Evanston, Ill.
Clifton Conduit Co., Jersey Cy., N. J.
Gen. Electric Co., Bridgeport, Conn.
The Steelduct Co., Youngstown, Ohio
Enameled Metals, Pittsburgh, Penn.
National Enameling & Mfg. Co., Pittsburgh, Pa.
Triangle Conduit & Cable Co., New Brunswick, N. J.

Prompt Deliveries on Properly Rated Orders

BM **BRIEGEL METHOD TOOL CO. • Galva, Ill.**

$$e = \frac{10.8 \times 1.73 \times 1.25 \times \text{line current} \times \text{cable length}}{\text{circular mils of line wire}}$$

Current rating of the 15 kva., three-phase transformer bank is:

$$I = \frac{\text{voltampere rating}}{1.73 \times \text{line volts}}$$

$$= \frac{15{,}000}{1.73 \times 208}$$

$$= 41.6 \text{ amps.}$$

Current capacity available for a 120 volt lighting load is equal to 41.6 minus 19.8 or 21.8 amps. If the lamp load is balanced, the current in the neutral will be zero.—R.G.C.

COMPUTING INTERRUPTING CAPACITY OF FUSES

A. TO QUESTION 181—Two alternate solutions are possible:

1—run two separate circuits, namely,
  a) one for the motor, permitting 5 percent voltage drop, and
  b) one for lighting load, permitting 2 percent voltage drop.

2—run one common circuit permitting 2 percent drop.

Solution No. 1

(a) The 1940 Code (Table 24) specifies for a 5 hp. motor, 3 phase, 220 volts, a current of 15 amps., and for 208 volts, 6 percent more, or 16 amps. A 5 percent voltage drop is equivalent to 0.05 × 120, or 6 volts drop to neutral, for a 300 foot run. This gives a "unit feeder length" of $\frac{300}{6} = 50$ feet per one volt drop to neutral. From the charts published in *Electrical World*, Vol. 110, 1938, July 2, p. 70, it is found that No. 10 AWG wire size may be used for 16 amps., 50 feet.

(b) The permissible lighting load is the difference between the total transformer capacity and the motor load. The motor kva is

$$\text{Motor kva.} = \frac{208 \times 16 \times \sqrt{3}}{1000}$$

$$= 5.1$$

Thus, the total lighting load may be $15.0 - 5.1 = 9.9$ kva.

The corresponding phase current is

$$\frac{9900}{\sqrt{3} \times 208} = 27 \text{ amps.}$$

A 2 percent drop is equivalent to $0.02 \times 120 = 2.4$ volts to neutral, and the unit feeder length is

$$\frac{300}{2.4} = 125 \text{ feet}$$

The diagram gives for 27 amps. and 125 feet a wire size of No. 4 AWG

Solution No. 2

The total current is $\frac{15000}{208\sqrt{3}} = 42$ amps.

The unit feeder length, for 2 percent drop, remains 125 feet. The chart

gives No. 2 AWG for this condition.

Cost comparison (based on figures published in *Electrical Contracting* May 1940, p. 40) is as follows:

Solution No. 1.

Power—No. 10 AWG, $10.80 per 1000 ft.

Light—No. 4 AWG, $37.40, 1000 ft.

Total—$48.20 per 1000 ft.

Solution No. 2.

Power and light—No. 2 AWG, $54.60 per 1000 ft.

Solution 1 is somewhat cheaper as far as the wire is concerned. However, the installation costs are higher so that in the end, both solutions will cost about the same. It should be added that in each case a neutral wire is required for the lighting circuit. If the load is equally divided between each phase and neutral, its current will be rather small.—L.F.R.

A. TO QUESTION 181—A 5 hp. 220 volt, 3 phase motor would have a normal full load current of 15 amperes. At 208 volts, the current will be increased about 6 percent to 16 amperes. Based on current carrying capacity, No. 12 rubber covered wire could be used. Since the circuit is to run 300 feet, however, the voltage drop must be considered. The formula for determining wire size is

$$CM = \frac{10.8 \times 2 \times \text{feet} \times \text{amperes}}{\text{voltage drop}}$$

$$= \frac{10.8 \times 2 \times 300 \times 16}{6}$$

$$= 17{,}280$$

This is allowing a 3 percent drop and figuring on the normal full load current. If 25 percent overload is assumed circular mil area of the wire would be 21,600. No. 6 wire will be satisfactory, since the smaller wire figured is slightly larger than No. 8, and the larger wire figured is slightly smaller than No. 6.

Potential drop for the wire size selected can be determined from the above formula rearranged as follows:

$$E = \frac{10.8 \times 2 \times \text{feet} \times \text{amperes}}{\text{circular mils}}$$

$$= \frac{10.8 \times 2 \times 300 \times 16}{21{,}600}$$

$$= 4.8 \text{ volts}$$

The current in each line wire to the motor, and in each transformer, would be 16 amperes at normal full load. The current in the neutral wire would be zero. Allowing for a 25 percent overload, the line current would be 20 amperes.

The current in a 5 kva. transformer is 41.6 amperes. It is assumed that the 20 ampere motor current is at 90 percent power factor. Thus about 18 amperes are in phase with the transformer voltage, and 8.7 amperes lagging 90 degrees, leaving an additional 22 amperes for lighting.—J.E.W.

Beaver "4" Way

One Piece Threaders ¼ to ¾" Adjustable!

Popular favorites for many years. Patented design. Nothing similar on the market. Fully self-contained. No loose dies—no loose bushings. Fully adjustable for standard, oversize or undersize threads. Thread ¼, ⅜, ½ and ¾. ⅛th inch dies extra, when desired.

Buy through any leading supply house.

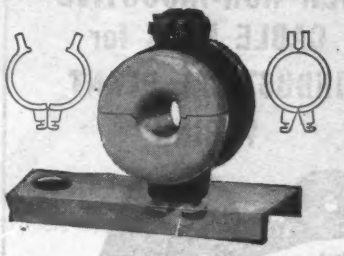
Write for latest 48-Page Catalog No. 44 of hand tools and power units and machines.

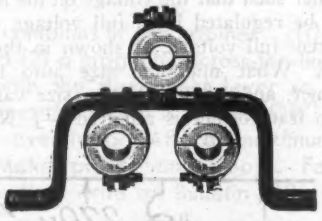
BEAVER PIPE TOOLS

744 DEEN AVENUE **WARREN, OHIO**

"EFFICIENCY" DEVICES FOR CONDUIT AND CABLE SUSPENSION

EFFICIENCY NESTED CONDUCTOR RACKS





Nested Conductor Racks available for Cable diameters from 5/16" to 2⅜".

• Simplicity is keynoted in the design of the EFFICIENCY bushing rack. Note that a single bolt supports the bushing and at the same time clamps the bushing support to the rack. Each fitting is a separate unit . . . permits the installation of each cable independently.

The EFFICIENCY rack is constructed of standard rolled steel channel—sizes according to size of bushings and number of mountings for each rack. Bushing supports are malleable iron. For A.C. service a brass half is furnished. Bushings are glazed porcelain, extra large and heavy.

Complete information on all EFFICIENCY Electrical Devices is available. Write today for your copy of Catalog No. 38A.

Efficiency ELECTRIC AND MANUFACTURING CO.

MANUFACTURERS OF EFFICIENCY ELECTRICAL DEVICES FOR CONDUIT, WIRE AND CABLE SUSPENSION

EAST PALESTINE, OHIO

Simplify
Wiring Jobs
WITH
PAINE
PIPE
STRAPS

SPEED UP EVERY INSTALLATION

For fastening thin wall pipe, BX, rigid conduit and non-metallic sheathed cable. Made from uniform gauge Galvanized Steel with raised center rib for added strength. 14 different sizes in each style.

Available in 5 lb. and 25 lb. cartons and 100 lb. bags. Guaranteed number of pieces to lb.

Straps meet government specifications.

Ask your Supplier or Write for Catalog

THE PAINE CO.

2961 Carroll Ave. Chicago 12, Ill.

Offices in Principal Cities

PAINE
FASTENING and HANGING DEVICES

SIMPLICITY PLUS!

NEW NON-INDUCTIVE CABLE RACK for INDUSTRIAL PLANT WIRING

Standard Type D-F 3-phase rack converted to 4-wire 3-phase by attaching type F-S Support for supporting fourth conductor. Racks available for Cable sizes from 5/16" to 2¾"

Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked cables only partially surrounded by metal eliminates any chance of inducted current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction . . . installation of cables made quick and easy through the use of split bearings.

Send today for Bulletin C-S-51 . . . describes these and other M. & W. items.

Hook-Mounting and Bar-Type Cable Racks • Messenger Wire and "Bull Dog" Conduit Hangers • "Bull Dog" Insulator Supports • Ground Clamps

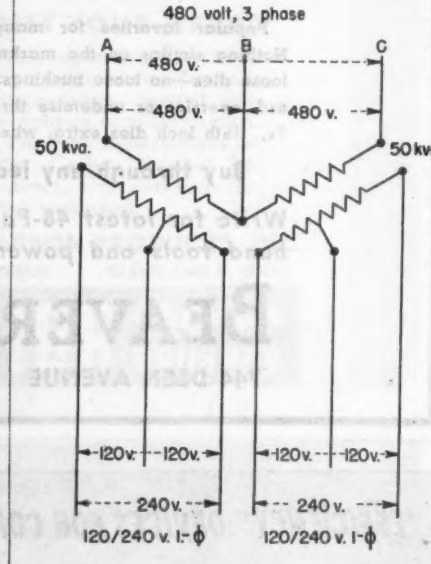
THE M. & W. ELECTRIC MANUFACTURING CO., INC.

EAST PALESTINE, OHIO

Can you ANSWER these QUESTIONS?

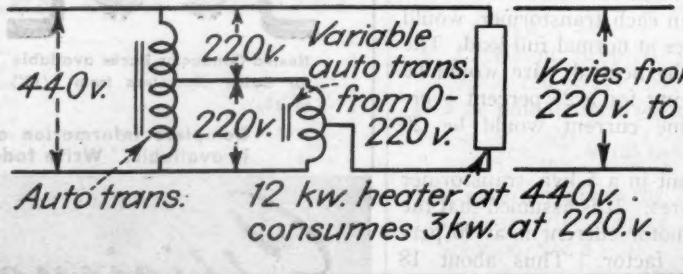
QUESTION C8—How can the current ratings of silver and copper contacts be figured for different contact pressures?—H.S.

QUESTION D8—In changing over our plant lighting, which consists of both incandescent and fluorescent, I expect to use the transformer connections shown in the accompanying sketch. Each single phase



transformer is rated at 50 kva., and secondary circuits are not interconnected. How much load will each unit carry? What will be the primary currents in phase wires A, B and C, and what is the formula used in the calculation?—E.E.D.

QUESTION E8 I have an electric heater which is supplied by a continuously variable auto transformer and an auto transformer such that the voltage on the heater can be regulated from full voltage to 50 percent full voltage, as shown in the circuit. What minimum size auto transformer, and what minimum size variable auto transformer is required?—J. N. R.



QUESTION F8—About 18 months ago, we purchased two dozen wet batteries to take the place of hard-to-get flashlite dry cells. We also purchased a six unit copper oxide rectifier for charging the batteries from the same company.

After the batteries had been in service for about six months, we noticed one or two of them cracked. We assumed this to have been caused from rough handling, but, as more casings cracked, we proved this was not the cause. Some of the batteries that haven't cracked will not take a satisfactory charge when placed in the charger. The pilot lights burn only about one half as brightly as when a good battery is placed on charge.

Our electrolyte is a dilute sulphuric acid (H_2SO_4). Can anyone tell us the cause of our trouble and the remedy?—T.B.

QUESTION G8—We are contemplating the installation of two 4000 hp. 900 rpm. synchronous motors. If installed, these motors will be placed adjacent to each other. Is surge protection necessary in an installation of this type? If so, what is the reason, and what equipment will be required? I would also like a diagram of the necessary connections.—G.S.E.

QUESTION H8—We have several ¾ hp. single phase repulsion induction motors which have special built frames and operate vacuum pumps. We would like to convert these motors to three phase operation. The armature shafts are longer than standard motors and carry the pump impellors. Replacement of these is out of the question. Therefore, we would like to rewind the stators for three phase and simply short circuit the entire commutator for the job. Would these motors operate efficiently connected in this manner?—L.G.D.

PLEASE SEND IN YOUR ANSWERS BY AUGUST 1

A-B Combination Starters on Oil Spray Precipitators used with Pratt & Whitney grinders.

The A-B combination starter combines in one cabinet... (1) a hand-operated disconnect switch and (2) a magnetic across-the-line starter ... mechanically interlocked with the disconnect lever so that the cabinet cannot be opened unless the switch is in the "Off" position. Saves space — saves wiring — saves labor. Affords maximum safety to man, motor, and machine. Makes plant changes easy. For full information on this low-cost protection, write for Bulletin 712.

With disconnect lever in front, A-B combination starters can be "ganged" in groups.

ALLEN-BRADLEY

AUTOMATIC MOTOR CONTROL

Are you familiar with Allen-Bradley Precision Limit Switches . . . those rugged but highly sensitive units for precision control of sequence operations? Send for Bulletin 802.

Is your File up-to-date on Limit Switch Developments?

Limit switches are so important in automatic motor control that it takes 72 pages in the Allen-Bradley catalog to list all the latest developments in A-B limit switches. An additional special 24-page technical bulletin tells how and how-not to install them.

Let us send you this 96-page limit switch catalog for your file. It is full of valuable suggestions, diagrams, and pictures . . . just what every machinery engineer needs to solve unusual motor control problems. And for the tough jobs call your nearest Allen-Bradley engineer. There is no obligation.

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

ALLEN-BRADLEY

LIMIT SWITCHES FOR EVERY SERVICE

QUALITY

Estimating Residential Wiring

[FROM PAGE 68]

Further study of Estimate 5 will reveal how the "4-Unit System" compensates for variation in the number and types of outlets that may be encountered in different jobs. Note that the overall cost per outlet for the 37 outlet home (Case I) is $2.79 compared with $2.60 (Case II) for the 50 outlet home. The units may be high or low, but any normal change would not affect this ratio.

There is a difference of 19 cents per outlet in the estimated wiring cost of the two homes. If the addition for operating costs and return amounted to a 25 percent markup, the difference in selling price would be 23.7 cents.

Suppose a contractor, by careful selection, could get half of this amount —or 12 cents per outlet—more than his competitors. At a cost of $2.60 with a 25 percent markup the selling price would be $3.25 per outlet. A 12-cent gain would be 3.7 percent of this selling price—indeed, a handsome gain. Many electrical contractors are operating their entire business with a return of less than 3.7 percent. It should not take an exceptionally good business man to appreciate the significance of such figures.

Contractors may expect, as in the past, that large groups of homes will be constructed having almost identical electrical layouts. This may occur to some extent, but the tendency, today, is to get away from such stereotyped layouts. The contractor who has a sound basis for estimating—specific unit costs for each type of outlet and segregated portions of the wiring system as outlined in the 4-Unit System—will be in a position to accurately figure all types of residential wiring.

It is reasonable to expect that existing, experienced residential electrical contractors will make some money when their line of work really opens up and that they will be able to cope with the competition of established contractors who may enter this field. The stiffest competition will be from the new group with its inevitable smattering of "nuisance contractors"—those who can't make money for themselves and spoil the business for the "regulars"; the type where two or more spring up as fast as one goes broke. There should be enough business for all. Let's hope that the contractors will keep their heads, use sound estimating practice and not bid each job as though it would be their last.

• RUBBER POWER CABLES • VARNISHED CAMBRIC CABLES •

• BUILDING WIRE • SERVICE ENTRANCE CABLE • SHEATHED CABLE • NON-METALLIC CRESFLEX • ARMORED CABLE •

• PERMACORD • LEAD-ENCASED AND PARKWAY CABLES • SYNTHOL WIRES • WELDING CABLES • SHIPBOARD CABLES

CRESCENT IMPERVEX TRENCH CABLE

Type RR FOR USE UNDER GROUND

Suitable for installations in ducts or in direct contact with the earth. The copper conductors are insulated with IMPERVEX moisture resisting Type RW insulation and are permanently protected by a heavy, tough Neoprene jacket that is sunproof, flameproof, and highly resistant to oil, acids, alkali and water. It is approved by Underwriters' Laboratories as Type USE-Underground Service Entrance Cable.

CRESCENT IMPERVEX TRENCH CABLE—Type RR provides a low cost, easily installed, permanent, underground circuit between power line and buildings or between buildings of mines, institutions, farms, and estates, etc. Furnished in sizes #14 to #4/0 A.W.G., two, three and four conductors. Our Engineering Department will be glad to recommend a cable best suited to your needs.

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

CRESCENT WIRE & CABLE

• IMPERIAL NEOPRENE JACKETED PORTABLE CABLES •

EVEN THE Worrybird CAN'T WORRY ABOUT THIS MOTOR

Can't worry about premature breakdown.

The Crocker-Wheeler Protected-Type Motor is built to last. Frame and shields have no openings above the horizontal center line, which means that dripping liquid and falling metal chips won't get in to damage the interior working parts. Vinylastic insulation makes coils dirt, oil, and moisture resistant to a high degree. Phase insulation provides added protection. Dynamically balanced, ALUCAST rotor is practically indestructible.

Can't worry about maintenance.

Patented bearing seal for ball bearings (sleeve bearings are optional) is so effective that re-greasing is required only once a year or even less frequently. This seal permits use of softer grease for better lubrication and longer bearing life.

Can't worry about first cost.

Despite all these advantages, Protected-Type Motors cost no more than conventional open types. They combine added protection with the surplus capacity (40C rise with a 15% service factor) of the open motor.

Why not investigate the many advantages of this new motor—to see if you can't end your own worries? Send for your FREE copy of descriptive bulletin, DL-121, that shows how these motors are protected, where they should be used, why they will give long trouble-free service. Write today—no obligation.

CW-1

CROCKER-WHEELER

A DIVISION OF JOSHUA HENDY IRON WORKS, AMPERE, NEW JERSEY

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON

MOTOR SHOPS

FROM WELDER TO WINDING HEAD

As V. A. Pinkerton, shop superintendent of the Fred W. Kiemle motor repair department, Toledo, Ohio, was watching the dismantling of an old 25 kva. electric spot welder that had come into the shop, he got an idea. The welder had a pretty substantial base of ideal height and winding machines were hard to get these days. As the picture of an additional piece of shop equipment took form, he rescued the welder base from its trip to the scrap pile and set to work. After he was finished he had a winding machine with a speed range of 12 to 1100 rpm. and magnetic braking.

Here's how he did it. Starting with 1 hp. 220-volt, 875 rpm., d-c motor he added armature and field control and arranged it so the armature could operate on either 110 volts or normal 220 volts. This gave him a dual speed range right away. A motor armature on 110 volts, with the field on 220 volts, will run at half speed.

The motor mounted to the back of the base, drives a 4-speed automobile transmission through a V-belt, jackshaft arrangement located inside the base. Because of possibilities of heavy torque on the winding head shaft—particularly with heavy rectangular wire coils—the drive from it to the transmission is of the chain and sprocket type. A magnetic brake assures quick stopping of the winding head at any desired position. A revolution counter, mounted on the plywood top of the machine, is belt driven by the winding head shaft.

The electric controls, as well as the transmission and drive shafts are located inside the old welder base. The operating handles are mounted to a plain face plate. These controls include: a pushbutton to change the armature from 220-volt to 110-volt operation; a reversing switch; a field rheostat; and d-c starter (armature resistance). Machine operation is controlled by a foot pedal.

Salvaged welder base became a multi-speed coil-winding head at the Fred W. Kiemle Co. motor repair shop in Toledo, Ohio. Alterations included addition of a d-c motor (dual voltage armature) with armature and field control, auto transmission and necessary V-belt and chain drives.

FAIR DISTRIBUTION NEEDED

Fractional horsepower motors are scarce. Motor repair shops over the country are having one hell of a time getting enough for the most essential replacements. And every single motor released to the motor shops is going into useful and vital work.

The scarcity, however, is a good deal less apparent in the electrical departments of some of our big retail chains. They are getting fractionals regularly. And since L 123 has been revoked they can sell them across the counter to any Tom, Dick, or Harry that wants one.

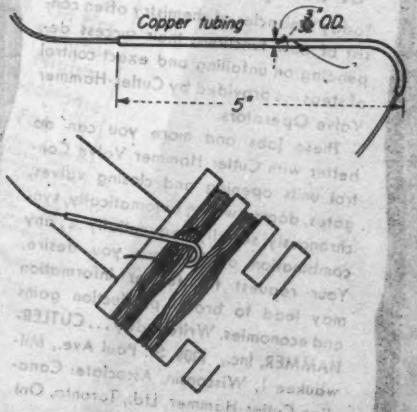
Wherever the fault lies, whether in too rapid relaxation of WPB controls or in indifferent distribution policies in the industry, it is time for the motor shops and dealers to register a squawk. Their role in holding together our rapidly depreciating electrical equipment is of such vital importance at this stage of the national economy that they ought to have access to every fractional that can be released.

Full speed range with the armature on 110 volts is from 12 to 550 rpm., with the armature on 220 volts, from 25 to 1100 rpm.—the intermediate steps in each case being accomplished by armature and field control and the transmission.

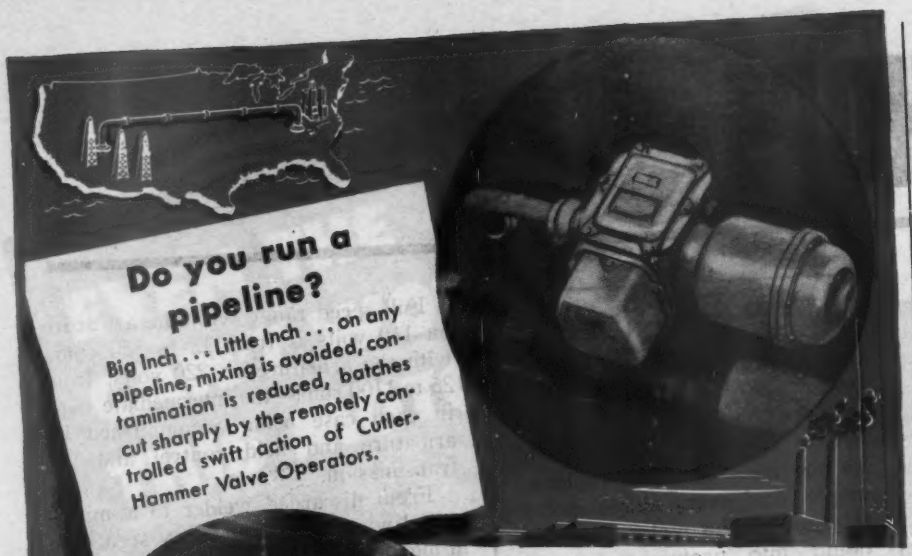
From discarded welder to a multi-speed winding machine may seem like a big jump. But not to the motor shop man whose business is repair and conservation; whose ingenuity has resurrected many obsolete pieces of electrical equipment to active industrial service during the war period. It's all in a day's work.

STRING "NEEDLE" FOR COIL TYING

As coils lay in the slots of the winding heads, ready to be tied, there is not room for the fingers to go between and around the coils to get the string in place for tying. This has a tendency to slow up the work, and as O. E. Norton of the Superior Electric Works, Los Angeles, is anything but slow he made this hollow "needle" out of ⅛-in. O. D. copper tubing, inserted the string and bent the end over into a hook. With it, the end of the string can be slipped under and around the coil with ease. When through far enough for making the tie, the needle is simply slipped back along the string ready for the next time. One "threading" is all that is necessary to a ball of string.



Hollow needle with hook end is used to thread tying string under magnet wire coils on winding head. Copper tubing does the trick.



Do you run a pipeline?

Big Inch . . . Little Inch . . . on any pipeline, mixing is avoided, contamination is reduced, batches cut sharply by the remotely controlled swift action of Cutler-Hammer Valve Operators.

Or a power plant?

When valves and wheels are too hot to handle, impossible of operation by manual means in high-pressure high-temperature steam practice, Cutler-Hammer pushbutton actuated, remotely controlled Valve Operators open and close valves quickly, unfailingly, safely.

Do you operate a waterworks?

Or a sewage disposal plant? Control of all flow, all functions, is vested in a compact board at your desk in your office. With C-H control you KNOW. Distance means nothing. C-H Valve Operators begin operation the instant you touch the button.

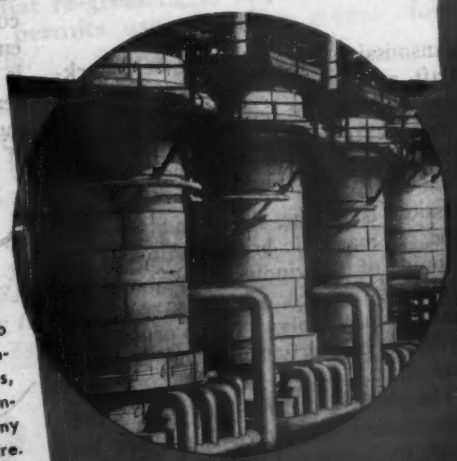
Engage in petroleum refining?

Take a tip from the use of C-H Valve Control in high-octane refining for fully automatic, interlocked sequence or independent control of all valves at all times in no time at all.

Or flow-process chemistry?

Today's miracles of chemistry often consist of flow functions, their success depending on unfailing and exact control of steps . . . provided by Cutler-Hammer Valve Operators.

These jobs and more you can do better with Cutler-Hammer Valve Control units opening and closing valves, gates, doors, swiftly, automatically, synchronously, serially, sequentially . . . any combination of functions you desire. Your request for further information may lead to broad production gains and economies. Write today . . . CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ont.

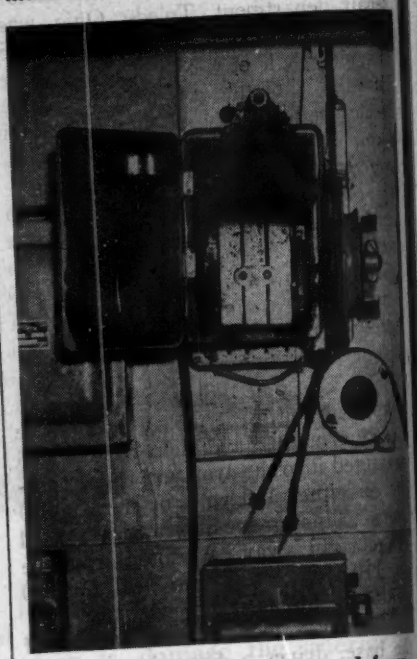


CUTLER-HAMMER
VALVE CONTROL
C-H

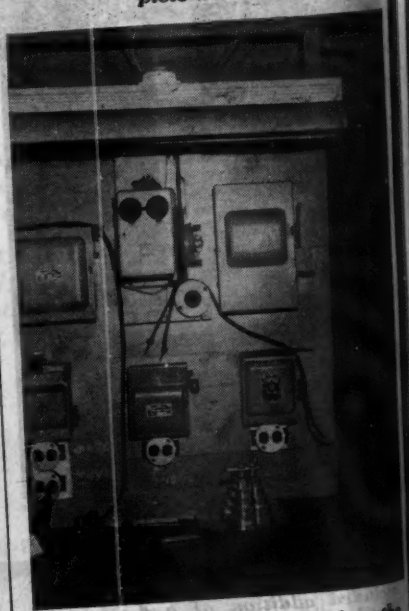
OLD TELEPHONE NOW A TEST SET

Remember the old type of telephone that required a bit of persistent cranking before one could get his party? There aren't so many of them in use today, but occasionally one turns up here or there.

A couple of them are in use at the electric motor repair shop of the Columbus Electrical Works, Columbus, Ohio—not as communicating instruments but as test sets. They are mighty



Motorized magneto fashioned from an old style telephone box serves as test set in this Columbus, Ohio motor repair shop. A wooden pulley, driven by a small motor overhead, is attached to the magneto crank shaft. Long test leads complete the set.



View of test bench showing the motorized magneto with cover closed. Recognize the old style telephone box?

BUSINESS BOOM WILL BEGIN . . . *in the Attic*

Full-page advertisements like this in GOOD HOUSEKEEPING are reminding your customers that an Emerson-Electric Home Cooler Fan tops the list of postwar home improvements. It's just one in the series designed to help rebuild business for you when Emerson-Electric appliances again become available.

"We're gonna build our home from the attic down!"

. . . that's where we'll install the Emerson-Electric Home Cooler Fan

"I found out about Emerson-Electric Home Cooler Fans when I was stationed down in Texas. Almost every house had a fan in the attic. It gets darned hot down South in summer and those people know all the latest tricks on keepin' cool. When the sun went down they'd turn on the attic fan, and presto, all the hot air was pulled right out of the house and replaced with cooler outside air, drawn in through the open windows and doors. It was really neat.

"I figured right then that when we planned our house we would start with the attic and specify an Emerson-Electric Cooler Fan."

Smart figuring, Soldier . . . because Emerson-Electric Cooler Fans are first in their field. They're made by the same people who have produced the famous Emerson-Electric fans since 1890.

THE EMERSON ELECTRIC MANUFACTURING CO. • ST. LOUIS 3, MO.
Brooklyn, New York • Chicago • Detroit • Los Angeles • Davenport

EMERSON MOTORS · FANS — EMERSON ELECTRIC — ELECTRIC APPLIANCES

On Hot Summer Nights Cool Your *Entire* Home With This Fan

Breezeless, humid, sleepless summer nights . . . free fashion fatigue, nerves cool off with a powerful EMERSON-ELECTRIC Home Cooler Fan installed in the attic. Then, with a click of the switch you can have cool, fresh air . . . make every room as cool as a sleeping porch. A low-cost cooling system every home can afford!

Are you going to modernize or build a new home? Write for complete information on Emerson-Electric Kitchen Ventilating Fans and Home Cooler Fans.

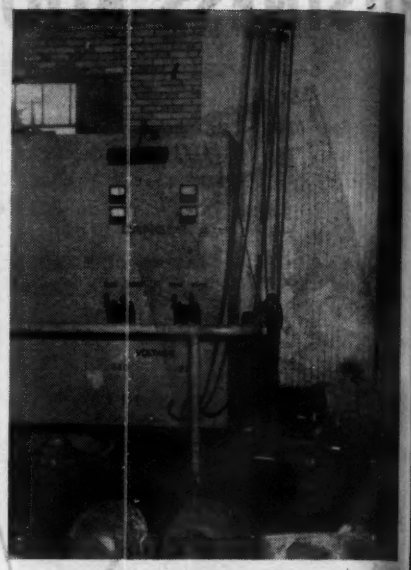
fine magnetos and come in handy for various test chores.

But O. L. Jeffries, president of the firm, wants his employees to have two hands free to make the tests. So he motorized the old telephone boxes, replacing the conventional crank handle with a wooden pulley attached to the magneto shaft and driving it with a small motor. Long test leads permit checking motors either on the test bench or at floor level. A toggle switch controls the motor circuit.

use it properly, but after that it is easier on the operator.

"With a revolving rack, there is no danger of getting cross turns, as in the case of the stationary rack, though this is not the main advantage, which is to reduce fatigue on the part of the operator", he explained. In stationary winding, the operator must be constantly leaning over and straightening up, pushing his arms a considerable distance out and then back again with every turn. This is tiring and in the long run cuts down production.

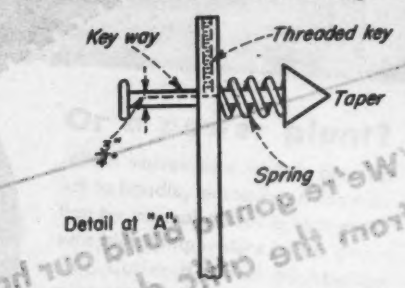
"In the case of the revolving rack, what you do is practically 'reel' the wire into the slots on what amounts to a horizontal reel. With a little practice, you get so that you hardly raise or lower the body or force it forward or back at all. Arm motion is cut to a minimum."



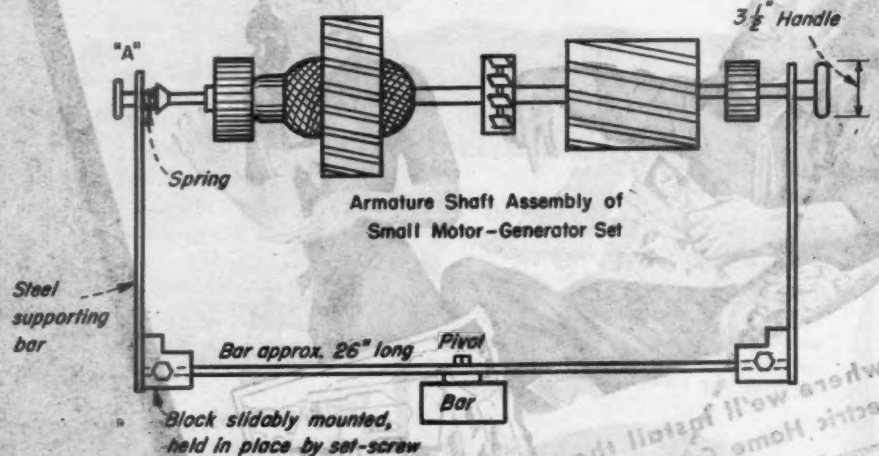
Dead-front test board at Fagan Electric Co., Little Rock, Ark., is conveniently located at the receiving door of the shop where running tests can be made on incoming and outgoing motors. Counter-weighted test leads can be plugged into test jacks at bottom of board—either 440-v. or 220-v. three-phase—to handle motors up to 250 hp., 440-v. Three, 50-kva., single phase transformers serve the board.

REVOLVING RACK FOR HAND WINDING

In hand-winding small armatures, some prefer the stationary rack and some the pivoted or revolving type. According to E. Maguin of the AAA Electric Motor Service, Los Angeles, the revolving rack has it all over the stationary type. As with any other tool, he says, one must learn how to



Spring tension on taper point permits revolving armature shaft in the winding rack.



Adjustable rack facilitates hand winding of small armatures. Pivoted mounting permits 360 degree swing of rack during winding operation.

In common with many motor men, Maguin has his own ideas as to how a tool should be built to suit the purpose as indicated by his own experience. Consequently, he has designed and built his own pivot rack as roughly indicated by the accompanying sketch.

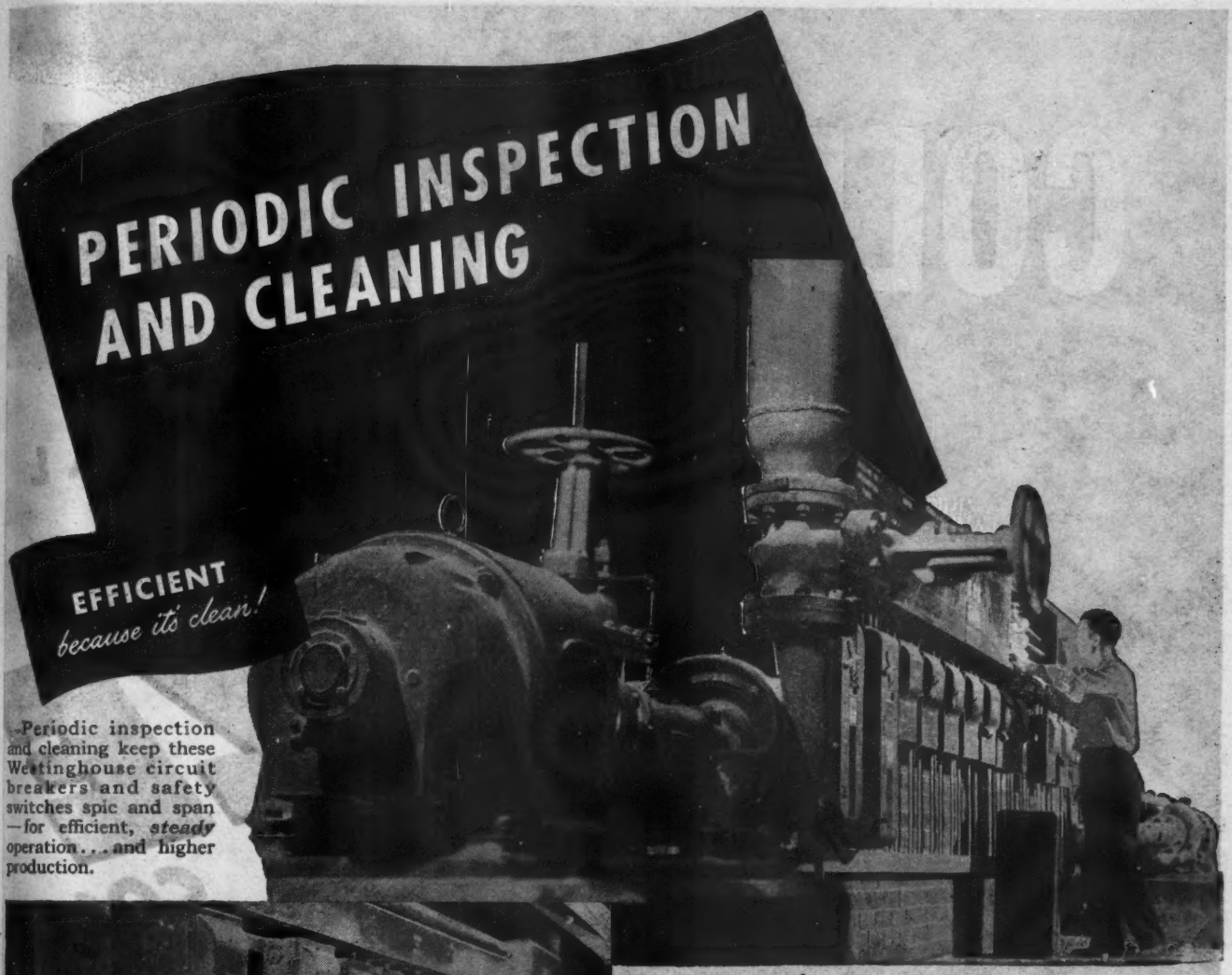
The main features are these: The pivoted arm may be made in various lengths, to suit the size of the work. He employs two; one being 20 inches long and the other 26 inches. The blocks on the ends slide back and forth on the arm and carry the uprights between which the armature shaft is mounted. The adjustable blocks permit insertion of the work and they are held by small set screws.

The shaft is held between two taper points. The one on the right is held in the upright by screw threads. The one at the left, A, is held differently as shown by the detail.

Between the taper point at A and the upright is a spring. This facilitates getting the shaft in place and adjusting the pressure of the points so that the shaft and armature will turn easily under the hand in winding from slot to slot but will not be free to spin at every touch.

Revolving rack for winding small armature coils. In this case it is being used for a small motor-generator shaft assembly.

PERIODIC INSPECTION AND CLEANING



EFFICIENT *because it's clean!*

Periodic inspection and cleaning keep these Westinghouse circuit breakers and safety switches spic and span—for efficient, *steady* operation . . . and higher production.

INEFFICIENT *because it's dirty!*

These safety switches are badly in need of a thorough house cleaning. Dust accumulations such as this prevent normal heat radiation and raise operating temperatures.

In the urgency of war production, inspection and cleaning of vital control, such as enclosed breakers and safety switches may have been overlooked. Because these are vital links in your plant power distribution system, Westinghouse recommends periodic inspection and "house cleaning".

Benefits are manifold: reduced maintenance, higher operating efficiency and safety standards, protected investment, and not least . . . increased production.

Safety switches and Type AB-I circuit breakers are only two items of the Westinghouse complete line of standardized control. For *any* control, call your Westinghouse office, or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-60604

Westinghouse Recommends These Steps When Inspecting Safety Switches

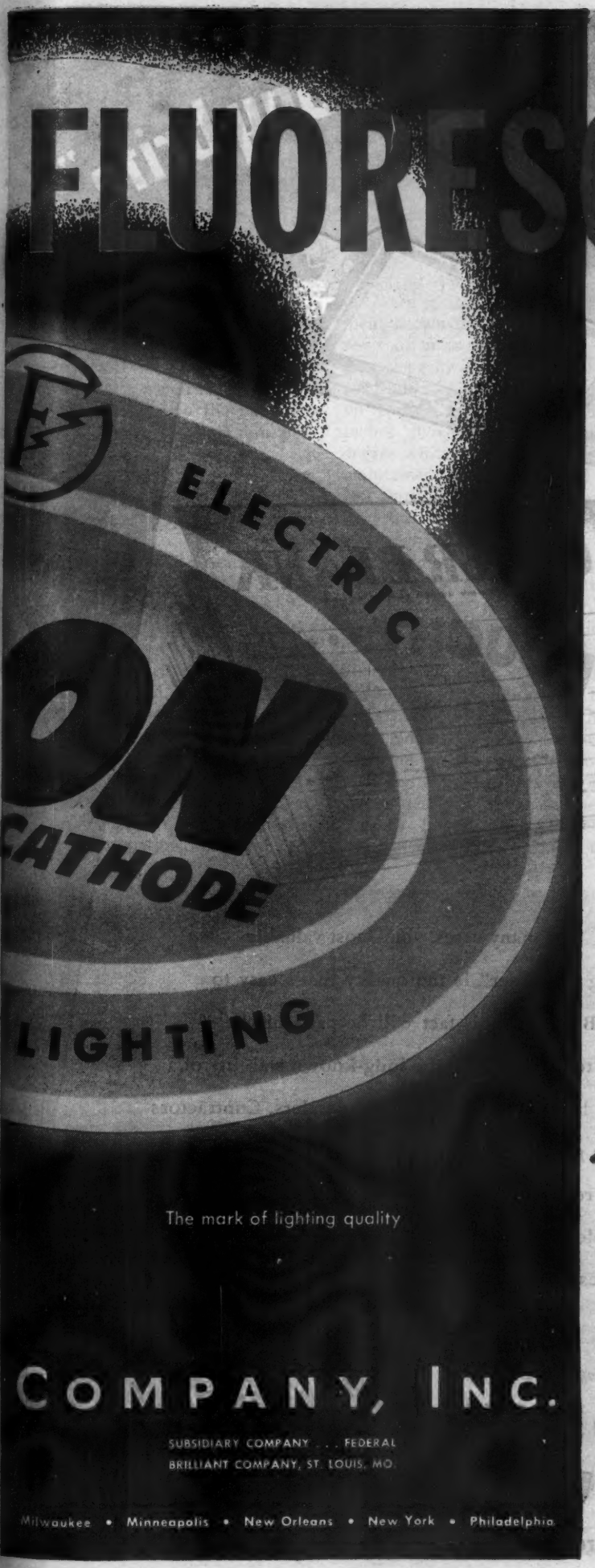
1. Make sure disconnect ahead of switch is open.
2. Clean contacts, and check for alignment and proper pressure on hinge and break jaws. Apply light coat of sludge-free lubricant.
3. Remove and clean fuse contacts with fine sandpaper; check fuse ratings; tighten fuse contacts.
4. Clean switch base and insulating parts.
5. Make certain cable connections and lugs are tight.
6. Check switch for smooth operation, and clearance of arc extinguisher, safety shields, etc. Lubricate operating mechanism.
7. Keep cabinets clean and free from rust—and keep covers closed.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

AB-I BREAKERS AND SAFETY SWITCHES

COLD-CATHODE
FEDERAL
ZE
COLD
FLUORESCENT
REG. U.S. PAT. OFF.
LIGHTING DIVISION
FEDERAL ELECTRIC
8700 S. STATE STREET, CHICAGO 19, ILL.
TELEPHONE VINCENNES 5300
225 N. MICHIGAN AVE., CHICAGO 1, ILL.
TELEPHONE STATE 0488
Branch Offices: Cincinnati • Dallas • Duluth • Houston • Indianapolis • Kansas City • Louisville



a definite answer to *Better* lighting!

Any modern system of fluorescent illumination means infinitely better lighting. But of the two recognized systems, Cold Cathode fluorescent is *best.* ZEON Cold Cathode is preferred because it means far longer lamp life, lower maintenance cost, instant starting, constant light flow, fewer auxiliaries and greater flexibility in shapes, sizes, colors, and output.

Federal Electric Company, Inc. has pioneered in the development and use of gaseous discharge lamps. In creating and perfecting ZEON Cold Cathode fluorescent lighting, Federal Electric found new and highly practical methods for its adaption to industrial, commercial, and decorative display illumination.

In planning for post-war installations, specify FEDERAL ZEON. You, your architect, or contractor are invited to submit your lighting problems in a detailed letter. Our engineers will be glad to give it thorough and immediate attention. Address Lighting Information Service, Federal Electric Company, Inc., 8700 South State Street, Chicago 19, Illinois.

Remember **there are 2 kinds of fluorescent lighting!**

"Hot Cathode" is the common heater filament type of fluorescent lamp; "Cold Cathode" is the improved shell-electrode type, of which Zeon is the outstanding example. Long life, lower maintenance cost, greater flexibility are some advantages of Zeon Cold Cathode fluorescent lighting.

it's easy to see when it's "Day-brite"

WHEN FIXTURES ARE BOUGHT . . .

In many cases, your most valuable help in "getting the order" is the quality that's easy to see when it's Day-Brite. . . . This fact will be particularly important in the days to come. Then, the long-known stability of a product will be a definite asset to Wholesalers, Contractors and Dealers who are giving profitable support to their business reputation by including the complete Day-Brite line in their plans for sales.

The CORONADO
(pictured above)
A shielded-type unit, with diffuse glass side panels, and louvered bottom to prevent bug catching and make cleaning easy. Surface or suspension mounting. For complete details, write for Bulletin F-80.

97

Consult your nearest Day-Brite Engineering Representative.

DAY-BRITE LIGHTING
Incorporated
5436 Bulwer Ave. St. Louis 7, Mo.

THE SIGN OF Quality LOOK FOR THIS LABEL

Day Brite
LIGHTING FIXTURES

Nationally Distributed Through Leading Electrical Supply Houses

MODERN LIGHTING

CONTINUOUS LINE LIGHTING FOR MACHINERY

Canadian Propellers Limited, Montreal, Canada, has installed high level fluorescent illumination to provide the proper quality and intensity of light for easy and rapid performance of the usual tanks involved in the manufacture and assembly of aluminum propellers.

The main building is single story, saw-tooth design 180 feet wide by 450 feet long with a ceiling height (distance from floor to bottom of saw tooth) of 25 feet. Distance from floor to top of saw tooth is 34 feet. The main floor area is divided into sections or departments each requiring its own treatment. In the largest section, which is the Hub Department shown in illustration, the illumination obtained is of such quality that local or plus lighting is required only in one or two specific machining operations. In the other departments doing final parts inspection or blade grinding and finishing, higher levels of general illumination were required.

To provide general illumination in all areas, two lamp 40-watt fluorescent industrial type steel enameled reflectors were selected. In the Hub Department shown in illustration, continuous rows of units placed end to end running lengthwise of the building and suspended by steel cable are mounted on 13-foot 6-inch centers, 13 feet 6 inches above the floor. Using 3500-degree white lamps, 30 footcandles are maintained on a horizontal plane 3 feet above the floor. Luminaires were manufactured by Superior Fixtures, Montreal, Canada.

In the Parts Inspection Department, the same type units are mounted 8 feet 6 inches above the floor or 5 feet 6 inches above and parallel to the benches to give 55 to 60 footcandles horizontal illumination on the working area.

The Blade Grinding and Polishing Department is equipped with similar units mounted 6 feet above and parallel to the work. Since the operator's head and shoulders are over his work a good deal of the time and because he depends largely on direct reflected light for the examination of the blade surface, the lighting units are located forward of the bench or the work. Originally, white lamps were installed in this department but the plant engineers found that the operators preferred to work under daylight lamps so that lamps were changed. The level of illumination with daylight lamps is 55 footcandles on the work.

The lighting data was submitted by the Canadian Westinghouse Company of Montreal in conjunction with T. Pringle & Son, Contracting Engineers, Montreal to the Lighting Service Forum of the Illuminating Engineering Society.

SIDE LIGHTING FOR CLEANING BOOTH

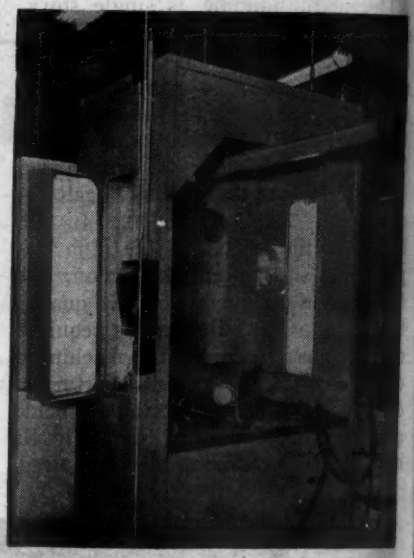
Engineered lighting, one of the outstanding features of the electrical installation at the General Motors Allison Division Plant No. 5 in Indianapolis (producers of Allison liquid cooled aircraft engines), is applied to

General view of the Hub Department where continuous lines of fluorescent light provide 30 footcandles on the working plane, in the Canadian Propellers Limited plant, Montreal, Canada.

individual equipment used throughout the plant. The spray cleaning booth in the motor repair section of the plant electrical maintenance department is one example.

When a man cleans a motor or other equipment in this booth, he works under 32 footcandles of fluorescent illumination (measured on the grille on which the motor rests). Side lighting, accentuated by the light gray color of the booth interior, produces this result with an unusually high vertical component.

Two conventional RLM type industrial fluorescent units (with Masonite reflectors)—each containing three, 40-watt, 3500 degree white lamps—are used. They are mounted in a vertical position, a few inches above the working plane (the grille) on each side



Hinged enclosure holds conventional RLM type industrial fluorescent unit. Flexible cord extension connects unit to convenience outlet. Fixture can be left in metal enclosure for lamp replacement; removed for major repairs.

of the booth. Gasketed, clear, wire-mesh glass panels, mounted to a steel frame in the booth side, protect the fixture from the spray and fumes. The lighting unit itself hangs within a metal enclosure hinged to the exterior of the booth wall and held securely in place by a lever catch. Electrical connection is made by a flexible rubber covered cord plugged into a duplex receptacle on the booth exterior.

Maintenance of the fixture is simple. If lamps need to be replaced or renewed, the hinged enclosure is merely opened and the tubes inserted. If an auxiliary unit or starter should fail, the entire fixture can be taken out of the enclosure and replaced with a new unit while the old fixture is being repaired. Since the fixture is totally enclosed, cleaning is not a problem. Maintenance is confined primarily to lamp and starter replacements.

THERE'S ONLY ONE MOVING PART IN
Federal NOARK MAGNETIC MOTOR STARTERS
and that part moves on BALL BEARINGS!
Get that Ball bearing action! The biggest single feature in starters and contactors—and you'll find it exclusively in Federal Noark Conirak. You'll find the bearings smoothly quickly and accurately locating and guiding the entire assembly. You'll find friction (always present where there is motion) reduced to an extremely low point. Study the illustration carefully. This is only ONE of Federal's many superior features. Contact your local Federal Field Engineer. He'll show you this and many other exclusive features of Federal Noark Controls. Do it today!
FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
Executive Offices: 30 ... Manufacturers of Motor Controls • Safety Switches • Circuit Breakers • Service Equipment • Panelboards
BALL BEARINGS
The section in red represents the only moving part of the Federal Noark Magnetic Motor Starter. Simplicity itself!

FOR BETTER INDUSTRIAL LIGHTING . . . SPECIFY WESTINGHOUSE*

DESIGNED right
APPLIED right

PROBLEM: to achieve adequate see-ability in this bay, used for rough assembling work, a minimum intensity of 10 to 20 footcandles of illumination was recommended. Luminaires are mounted high for ample clearance of the crane.

"Lighting by Westinghouse" gives you BOTH

THE formula for good lighting requires two basic essentials. One is *lighting equipment* which embodies the latest advances in design features. The other is the *correct application* of the principles of proper illumination when designing a specific lighting system. These two essentials are equally important. And you get BOTH when you specify "Lighting by Westinghouse".

Where maximum illumination must be maintained at a minimum of maintenance expense . . . or where unusual conditions are encountered, look to Westinghouse.

Westinghouse lighting equipment is available in a full range of types and ratings from your Westinghouse distributor. Ask your nearest Westinghouse office for Bulletin No. B-3568, "Millite—for Heavy Industry". Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-04064

Illustrated left to right: Aluminum High Bay Reflector, Millite and 3 KW Mercury unit.

RESULT: correctly engineered lighting systems, as illustrated here, provide the right level of lighting to fit the task to be done. *The right luminaires, applied right,* minimize shadows, reduce glare, help to prevent accidents.

Westinghouse LIGHTING EQUIPMENT

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

AVAILABLE THROUGH 127 WESTINGHOUSE ELECTRIC SUPPLY CO. OFFICES AND INDEPENDENT DISTRIBUTORS

McGILL

INSIDE INSPECTOR LAMP NO. 7500

Brings the Inside OUTSIDE

The new McGILL INSIDE INSPECTOR LAMP, No. 7500, makes the inspection of shells, cavities, castings, tubes and other objects with a deep opening easy. Burrs, grease and defects cannot escape detection. The inspector doesn't squint and strain. A strong light is thrown inside where the light is needed . . . NOT in the eyes. The operator simply looks into the adjustable mirror. Write for data.

FEATURES OF THE No. 7500

1. **100 Watt—120 Volt—No. R-40-Spotlight**
2. **Adjustable Mirror**
3. **12 ft. Insulated Cord and Plug**
4. **Adjusting Wing Nuts to Allow for Tilting**
5. **Wing Nuts for Mirror Adjustment**
6. **Inspector's Vision at this Point**

ELECTRICAL DIVISION

McGILL MANUFACTURING CO., INC.
VALPARAISO, INDIANA

Continuous row fluorescent units light radio assembly work bench, providing more than 80 footcandles of shadowless illumination to speed production of vital radio equipment in this plant.

LOCALIZED LIGHTING WITH CONTINUOUS FLUORESCENT

A manufacturer of radios now busy with war contracts has adopted continuous row fluorescent industrial lighting to obtain a high intensity of comfortable illumination on the assembly benches of his plant. By installing Guth No. M-1656 two-lamp 40 watt industrial units mounted end to end to form a continuous row of lighting 30 inches above, and 12 inches from the front edge of the benches, from 80 to 100 footcandles of shadowless illumination is obtained on the work area, using standard 3500° white lamps.

Enclosing globe incandescent fixtures are used to provide general lighting and to relieve contrast of the background.

POWER FACTOR CONSIDERATIONS IN FLUORESCENT CIRCUITS

By J. H. AHRENS

Distribution Department
Hartford Electric Light Company
Hartford, Connecticut

Fluorescent lighting is advancing rapidly. It is fast becoming one of our leading standards for lighting. The postwar period will accentuate its use even more. National Electrical Code committees and others are considering the many problems involved, compiling data, and proposing new regulations governing the installation of this type of lighting.

Fluorescent lighting fixtures require not only lamps, but also ballasts, compensators and starters. Lamps, rated in watts, offer no unusual wiring problem. Ballasts, on the other hand, involving power factor considerations, create a problem which did not exist with incandescent lighting. Modern ballasts are of two types; one, of uncorrected or low power factor, the other, of corrected or high power factor. This fact creates some confusion and difficulty in calculating the associated wiring and making it safe from fire hazards.

Before the advent of fluorescent lighting, incandescent lighting loads were estimated by multiplying the floor area in square feet by the watts per square foot. Wiring was then provided as required by the Code for the load involved. The load was divided into 15 ampere branch circuits with 1725 watts on each circuit. No consideration had to be given to power factor, since incandescent lighting involves a resistance load only.

With fluorescent lighting loads it is also necessary to take power factor into consideration when estimating the branch circuits. A fluorescent lamp load of 1725 watts, if operated with low power factor ballasts, will approximately double the circuit currents. Low power factor ballasts will thus overload the circuits and cause fuses to blow. Fire hazards are increased, causing considerable concern by electrical inspectors. Failure to take into account watts lost in ballasts, or low power factor, each of which considerably affects the total load, results in badly overloaded circuits. With fluorescent lighting, the total lighting load is not the lamp wattage times the number of lamps, and lamp wattage divided by circuit voltage does not give the amperes in the conductors.

The effect of power factor on circuit calculations is demonstrated in the following comparison.

the RLM standards institute

and how it serves INDUSTRY

specifications

. . . . . The RLM Standards Institute is a non-profit organization operated to develop and promulgate standard specifications for the efficient performance of industrial lighting equipment. Every RLM specification is drafted by a Technical Committee, guided by the findings of the Illuminating Engineering Society, the recommendations of the Better Sight Bureau and other recognized industry associations. A specification becomes RLM Standard when it has been adopted by the members in accordance with the definite procedure proscribed in RLM Standard Institute Code of Regulations. These specifications are available without charge to everyone interested.

inspection

. . . . . Inspections and tests are made by a wholly independent laboratory . . . Electrical Testing Laboratories, Inc. Tests at the laboratory and periodic inspections at the plants of all participating manufacturers provide positive assurance that RLM Certified Industrial Lighting Units will provide the maximum value in lighting efficiency and economy.

certification

. . . . . If the equipment so inspected and tested meets the RLM specifications, the laboratory issues a label of compliance. This label, illustrated above, certifies that the industrial lighting on which it is affixed has been manufactured and inspected in compliance with the exacting procedure developed and administered by RLM Standards Institute.

participation

. . . . . A manufacturer of industrial lighting equipment may make his units in accordance with RLM specifications. If he so desires, he may at his own initiative and voluntarily submit his equipment for inspection and certification. He need not become a member of the Institute. It is only necessary for him to assume his equitable share of the cost of operating the program.

RLM STANDARDS INSTITUTE, INCORPORATED
307 North Michigan Avenue • Suite 420 • Chicago 1, Illinois

Yes, you can now think about new signs . . . better signs . . . *properly illuminated.* It's time to act, too, to assure delivery of lighting equipment when you need it.

KEYSTONE
Emblem Sign Reflectors

Designed specifically for illuminating square or rectangular signs, the Goodrich Keystone Reflector provides maximum and uniform illumination. Its Keystone shape, with straight line sides provides light cut-off at exact edges of the sign, without waste of light. The light pattern is "tailored" to fit.

Permanent porcelain enamel finish makes it timeproof, weather-proof. The Goodrich Seprable hood makes it quick and easy to attach and detach without use of screws. Lamp burns in normal vertical position; resilient socket lengthens lamp life. Other Goodrich sign reflectors similarly illuminate round, oval, or long and narrow signs. The complete Goodrich line includes hundreds of sizes and styles of reflectors for every outdoor and indústrial need. Write for literature.

Sold Through Electrical Wholesalers

GOODRICH
ELECTRIC COMPANY
4600 BELLE PLAINE AVENUE, CHICAGO 41, ILLINOIS

Consider a load of 36 — 40 watt incandescent lamps on a 115 volt circuit. With unity power factor the current is 12.5 amperes at 115 volts. This load can be safely installed on a No. 14 wire circuit fused for 15 amperes, the typical lighting branch circuit. Now consider that a fluorescent lighting installation is made, using low power factor ballasts. It is assumed that 36 — 40 watt fluorescent lamps are used, that ballast power factor is 60 percent, and that the watts loss per ballast is 13 watts. The branch circuit current becomes 27.6 amperes (36 times 53 watts, or 1908 watts, which, divided by 115 volts times 60 gives the branch circuit load of 27.6 amperes). With the same lamp wattage, the branch circuit becomes overloaded by 12.6 amperes beyond fusing of 15 amperes. Thirty ampere fuses are now necessary to prevent blowing. This immediately increases the fire risk. Table 1 shows volt-amperes for the popular sizes of fluorescent lamps when operated with normal low power factor ballasts. At 60 percent power factor, there are 88.3 volt-amperes per 40 watt fluorescent lamp. This volt-ampere relationship is revealing when compared with lamp watts. The Code allows 1725 watts on 15 ampere, 115 volt circuits, but this load must be at unity power factor if the current is not to exceed 15 amperes.

Table II shows the relationship of total permissible lamp watts between incandescent and fluorescent lamps, for each size of fluorescent lamp, for installation on a 15 ampere branch circuit. The circuit load with incandescent lamps is 1725 watts for any size lamps, since power factor is unity. Variations in watts loss for different size ballasts, and for power factor, account for reduced permissible lamp watts on 15 ampere branch circuits when fluorescent lamps are used.

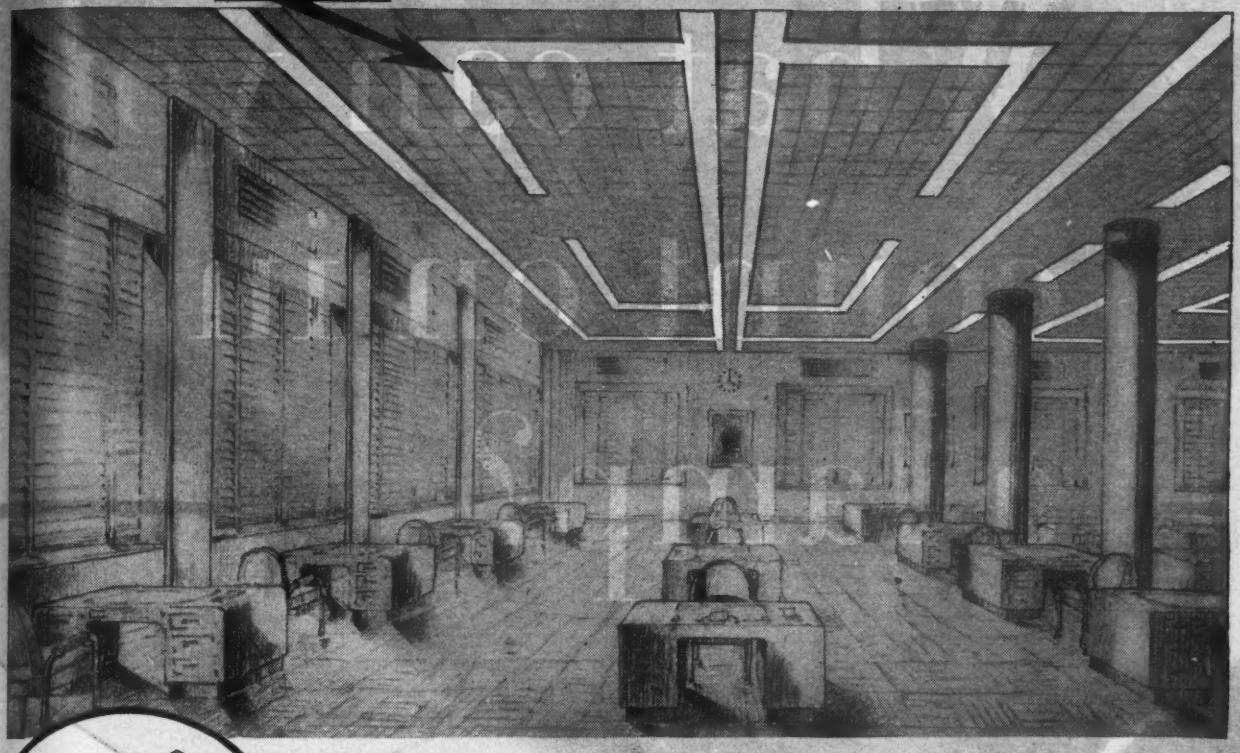
It is readily seen that if fluorescent lighting is selected for relighting existing buildings in order to obtain higher levels of illumination without rewiring, it will be necessary to use high power factor ballasts.

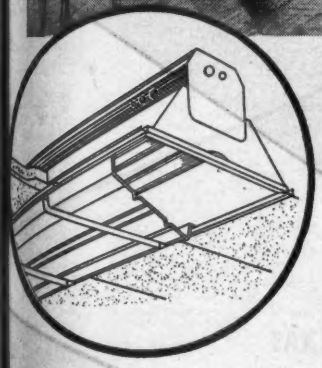
TABLE I

SINGLE FLUORESCENT LAMPS WITH LOW POWER FACTOR BALLASTS.

Lamp Watts	Watts Loss Ballast	Total Watts	Line Power Factor	Volts X Amps.
15	4.5	19.5	55%	35.4
20	4.5	24.5	55%	44.5
30	10.	40.	55%	72.7
40	13.	53.	60%	88.3
65	24.	89.	60%	148.
100	24.	124.	60%	207.

Follow *These* Lines of Least Resistance





Miller Fluorescent Troffer Lighting Systems

for offices, stores, factories, schools and public buildings

AID IN PLANNING
SIMPLIFY CONSTRUCTION
FACILITATE MAINTENANCE

They aid in planning because they suggest practicable new themes for interiors.

In geometric patterns or lightstrips "by the mile" . . . in a versatile variety of glass and plastic lenses, plates, and metal or plastic grilles . . . they encourage the modern trend to plan the *entire building* around the lighting.

They simplify construction because of mature, forward-looking engineering that solves past problems—without adding new ones.

For instance: The Miller patented bracket ends laborious fitting of recessed lighting systems into hung ceilings. Now, these brackets are hung from the structural ceiling and support both furred ceiling and Troffer Lighting System!

The true cost of any lighting system is the *complete* cost, installed and operating.

Miller Fluorescent Troffer Lighting Systems facilitate maintenance because they are engineered to assure *continuing* economies of operation.

Yes, from first to last, Miller Fluorescent Troffer Lighting Systems are an outstanding achievement of our times!

Miller field engineers are conveniently located to serve you.

Other Pluses of MILLER Fluorescent Troffer Lighting Systems:

Supports from structural ceiling reduced 50 to 75%.

•

Conduit and conduit fitting costs reduced up to 80%.

•

Wiring costs reduced up to 50%.

•

Permanent operation and maintenance economies.

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Material

MILLER
SINCE 1844

©1945 Westinghouse Electric Corporation

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

MAZDA LAMPS FOR SEE-ABILITY

just this

TAKE THESE LAMPS—fluorescent lamps by Westinghouse. What is there about them that makes them so bright, so long lasting? Westinghouse research . . . electrical "know-how" . . . precision manufacturing experience.

HOLD A FLUORESCENT lamp in your hand—this Westinghouse fluorescent—and it may seem about the same as any other fluorescent. But just put it in a fixture. Then, when you've seen it glowing uniformly bright from end to end . . . when you think of the thousands of satisfied Westinghouse fluorescent users, many of them *your* good customers . . . *that's* what you can count on in a lamp that says "Westinghouse". That's when you're happy to be selling *Westinghouse Lamps.*

WESTINGHOUSE PRESENTS *John Charles Thomas, Sunday 2:30 P. M., E. W. T., N. B. C.*
Tune in Ted Malone, Monday through Friday 11:45 A. M., E. W. T., Blue Network.

WESTINGHOUSE ELECTRIC CORPORATION LAMP DIVISION, • BLOOMFIELD, N. J.

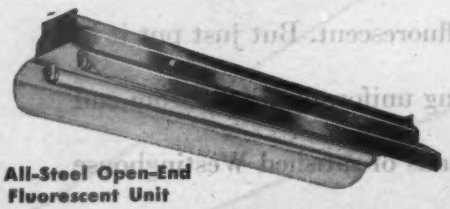
THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM...

Light lifts the Shadow from Plant Morale!

Better lighting of the Wheeler type... *Skilled Lighting*... means higher morale through reduced eyestrain and fatigue. When you raise morale with Skilled Lighting... backed by Wheeler's advanced engineering... you automatically get better production too!

Wheeler reflectors for fluorescent and incandescent installations are the product of 64 years of specialized light engineering. They are *engineered* to produce maximum illumination from standard lamps. They are *built* for long service and easy maintenance: high-grade, heavy duty materials throughout... heavy vitreous enameling that really stands up and retains its high reflection factor.

Learn how you can brighten morale and boost production – get acquainted with Wheeler's complete line of Reflectors. Write for Catalogs. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** Also New York. Representatives in principal cities.



All-Steel Open-End Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuou runs.

RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Distributed Exclusively Through Electrical Wholesalers

Wheeler Skilled Lighting REFLECTORS

Made by Specialists in Lighting Equipment Since 1881

TABLE II

TOTAL PERMISSIBLE LAMP WATTS ON 15 AMPERE BRANCH CIRCUIT.

Lamp Watts	Incandescent Lamps	Fluorescent Lamps @ Low P.F.
15	1725	731
*20	1725	775
*30	1725	712
40	1725	810
*65	1725	783
100	1725	866

*Incandescent not made in these sizes.

Tables I and II show the possibility of creating fire hazards if, in the calculation of fluorescent lighting loads, watts loss in ballasts and power factor are not taken into consideration. When ballasts used are of the high power factor type, fire hazards are reduced, and the lighting load can be estimated more nearly in the old simple way.

A new rule for the National Electrical Code for 1945 has been suggested, which would make the use of high power factor ballasts mandatory. Adoption of this rule seems to be the simplest way to overcome the fire hazards associated with the use of low power factor ballasts. It would contribute to greater safety in wiring.

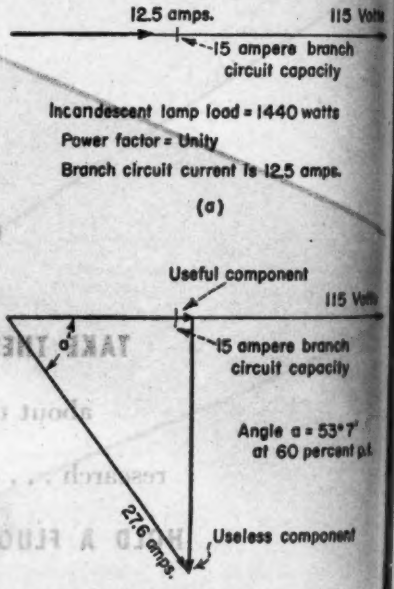


Fig. 1—Vector diagram (a) shows incandescent lamp load of 36 40-watt lamps operating at unity power factor on 115 volt circuit. Measured current is 12.5 amperes. 15 ampere branch circuit will not be fully loaded. Vector diagram (b) shows fluorescent lamp load of 36 40-watt lamps operating at 60 percent power factor on 115 volt circuit. Measured current is 27.6 amperes. 15 ampere circuit will be overloaded by 12.6 amperes.

Mitchell
Industrial Lighting

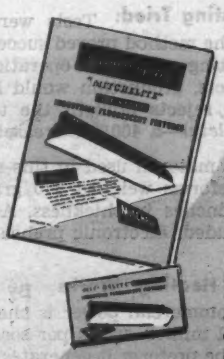
ALL THE LIGHTING FEATURES YOUR CUSTOMERS SEEK!... ALL THE SELLING ADVANTAGES YOU WANT! Every MITCHELL feature enhances the value of your industrial lighting service! Your customers are sure of more abundant, more efficient light for their workers. Greater mounting flexibility simplifies the installation job. Easier, lower-cost maintenance saves time and money. Rugged construction assures stability of performance and longer service.

All These Features

- ALL-STEEL REFLECTORS AND WIREWAYS
- OPEN-END OR CLOSED-END
- BAKED ON PORCELAIN ENAMEL
- "AIRCRAFT" INSTANT LATCH
- INSTANT-START MODELS
- EASY-MOUNT ACCESSORIES
- SINGLE OR CONTINUOUS ROW
- SURFACE OR SUSPENSION
- U.L. AND E.T.L. APPROVED
- RLM CERTIFIED

These all-around advantages, engineered and built into every unit by MITCHELL, bring you *more satisfied customers . . . easier sales . . . volume business!*

The complete MITCHELL line of 2-40, 3-40 and 2-100 watt models provides a ready answer for every industrial lighting need.



BUILD SALES WITH THESE AIDS!
Distribute full-size Catalog No. 287 and Pocket-size Catalog No. 290. Each tells full story.

MITCHELL
FIRST IN POPULARITY

Mitchell Manufacturing Company
2525 CLYBOURN AVENUE, CHICAGO 14, ILLINOIS
West Coast Factory and Sales Office: 1019 N. Madison Ave., Los Angeles 27, Cal.

HOW RCA TUBES INCREASED OUTPUT OF PLASTIC PARTS 400%

Electronic Preheating Cut Rejects, Shortened Operational Time, Simplified Molding of Intricate Plastic Parts at Kurz-Kasch

This 2000-watt RCA electronic generator can preheat one pound of plastic molding material to 275°F in about 40 seconds.

IN July 1943, Kurz-Kasch, Dayton, Ohio, plastics molder, was called upon to deliver a large quantity of high-priority molded pieces within a few weeks. Because the pieces were difficult to mold, rejects due to poor preheating ran as high as 65%; production of the required quantity seemed impossible to achieve in the time available.

Electronic Preheating Tried: Tests were made with electronic preheating, and the method proved successful. In actual practice, electronic preheating cut overall operational time by 50%. Thus, disregarding rejects, production would have been doubled. But, the reduction in rejects brought the total usable output to 5 *times its former level*—a 400% increase!

Job Details: The material used in this molding job was Melmac No. 592. The preforms weighed 370 grams, measured 4 inches across and 1½ inches in thickness. A large number of metal inserts were included. Electronic preheating time was only 45 to 50 seconds.

How Electronic Heating Works: By means of RCA electron tubes, 60-cycle commercial power is changed to power at a frequency of several million cycles per second. When this power is passed through the preform it generates heat *within the preform.*

Advantages of Electronic Preheating of Plastics: Heat is instantaneous and uniform throughout the preform pellet. When the power is shut off, heating stops immediately; there is no residual heat to coast temperatures beyond desired limits. With thermosetting plastics, which set with the application of high temperatures, the quick heating possible with electronic heat permits greater workability and results in fewer rejects. Production-line techniques can be employed, cutting processing time to a few minutes—or even seconds.

Working conditions are improved because no excess heat is dissipated into the work area; there are no gases or vapors to contend with. Electronic heating is noiseless, vibrationless, requires no special foundation or installation expense, and takes little floor space. Electronic-heating equipment is also a high-power-factor (90%) load on the plant electric-system.

Turn to Electronics for Solution of Your Own Problems: For information on the electronic-heating equipment used in this application, write to RADIO CORPORATION OF AMERICA, Electronic Apparatus Section, Camden, N. J.

Electron tubes are providing a practical solution to hundreds of diversified manufacturing problems—process control, machine control, heat-treating of metals, plant protection, and a host of others. Consult with RCA tube-application engineers for information or advice on the application of electron tubes in your own plant. For examples of electronics at work in industry, send for a copy of the free booklet, "16 Examples of Electron Tubes at Work In Industry." Write to RCA, Commercial Engineering Section, Dept. 62-57S, Harrison, N. J.

The Fountainhead of Modern Tube Development is RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, NEW JERSEY

PRACTICAL ARTICLES on the application, installation and maintenance of electronic apparatus in industry. Readers are invited to contribute items from their experience to this department. Articles used will be paid for.

ELECTRONICS

Installing, Maintaining and Servicing Electronic Resistance Welding Control—IV

By W. J. Gorman, Jr.
Industrial Control Engineering Div.
General Electric Company
Schenectady, N. Y.

SEAM welding has proved the solution to a great many production problems during the course of the war. As one example, there has been a great demand for air- and water-tight metal cylinders. Many of these, such as gas tanks, have been and are being fabricated from sheet metal. The seams of these containers are being welded together with electronically-controlled resistance seam welding machines (Fig. 1). This method of fabrication has proven a dependable and speedy means of producing these parts which are so vital to the war effort. For this reason, many factories have installed a large number of seam-welding controls and machines. The maintenance of this type of control is much the same as the spot-welding controls, although the timing circuits are more complicated and require more study.

Time Cycle Electronically Controlled

A seam-welding control is used to produce a series of spot welds. The spacing between each spot weld is determined by the speed of the roller-type electrodes and the time interval between welds. The electrode speed is usually controlled by means of a variable-speed motor drive. The time interval during welding (usually referred to as "heat" time) and the time between welds (usually referred to as the "cool" time) are electronically controlled on modern seam welding machines. The power and firing circuits are very similar to those used in electronic spot-welding controls. Originally, a mechanical timing disc or chain was used in the timing circuits of the first electro-mechanical type controls; while newer controls have been designed completely electronic.

Electro-Mechanical Timing

The electro-mechanical seam-welding control consists of a motor-driven chain, or disc, made up of conducting and non-conducting buttons or segments. A synchronous motor drive is used to maintain synchronism with the supply voltage. Each button of the chain usually represents one cycle or one half-cycle timing. The correct seam weld pattern is set up by locating the buttons in the desired sequence. A typical chain type seam-welding control is shown in Fig. 2.

The chain type seam-welding control employs a brush mechanism which

Fig. 2—Chain type seam welding control.

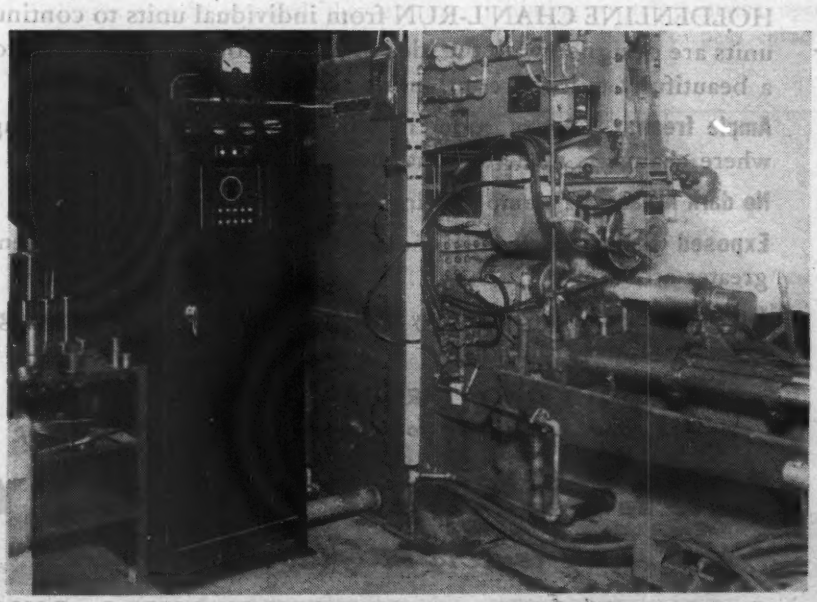
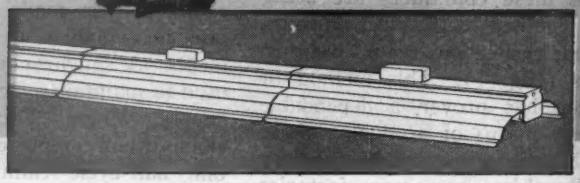


Fig. 1—A typical seam welding installation.

Get All Five Advantages by Specifying

HOLDENLINE CHAN'L-RUN

These illustrations show model CSS 80—two 40-watt lamps—and point out five good reasons why you will prefer HOLDENline Chan'l-Run Fluorescent fixtures.



Study the five pointed advantages HOLDENLINE CHAN'L-RUN offers you. Choose the fixtures which bring you high lighting efficiency based on correct photometric design—plus soundly engineered features which insure adaptability, flexibility and sturdiness.

Quickly convertible to continuous run. Should you want to step up your lighting—and everyone knows the trend to 100 footcandles minimum is spreading rapidly—you can swiftly change HOLDENLINE CHAN'L-RUN from individual units to continuous run. All HOLDENLINE units are designed with the idea of speedy conversion, at will, to a beautifully tailored continuous run installation.

Ample freeway. Lots of room in wireways permits easy rewiring where change is made to continuous run.

No dark Areas. 2½" lamp spacing.

Exposed Ballast. Provides cooler operation, fewer replacements, greater economy.

Butt-on sockets backed by heavy steel ends prevents socket breakage —lamps always firmly held.

SOLD ONLY THROUGH WHOLESALERS

Ask your wholesaler for Catalog B-45 or write to

HOLDENLINE COMPANY

Pioneers in Fluorescent

1960 EAST 57TH STREET, CLEVELAND 3, OHIO

Other units available are
CSS-85, 2-lamp 40-watt, 5" lamp spacing
CSS-120, 3-lamp 40-watt
CSS-200, 2-lamp 100-watt, 4½" lamp spacing

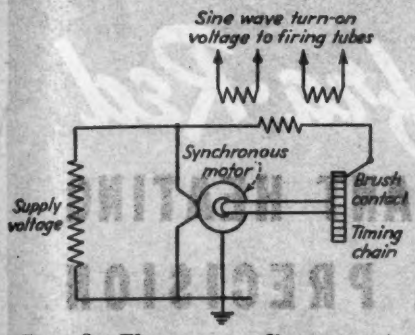
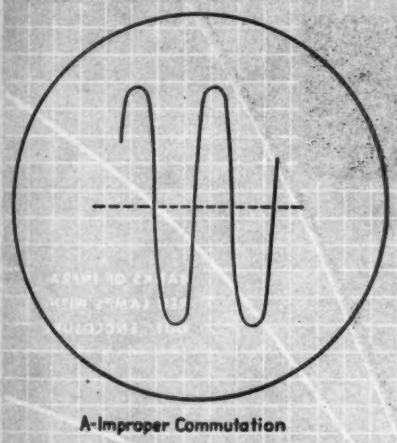


Fig. 3—Elementary diagram of chain type seam weld timing circuit.

is connected in series with the primary of a transformer energized from the supply voltage. Each time a conducting button passes the brush, this transformer is energized for one cycle (Fig. 3). This transformer has two secondaries, one being connected into the grid circuit of each of the firing tubes, each winding supplying the timed sine wave turn-on voltage to the grids of the tubes. Like all mechanical devices, the brush and buttons are subject to wear and will occasionally require adjustment. The position of the brush must be adjusted so as to give smooth commutation. This is accomplished by examining the voltage across the secondary of the turn-on transformer with a cathode-ray oscilloscope. The brush should be adjusted with a one- or a two-cycle weld or heat-time pattern. The cool-time is not important. By synchronizing the scope with the supply voltage to give a steady three- or four-cycle pattern, improper commutation will be indicated by a voltage pattern on the secondary of the transformer similar to that in Fig. 4A. With the correct location of the brush, electrical contact is made at the zero point in the voltage wave and the voltage will appear as in Fig. 4B.

The heat control circuit is similar to that of the spot-welding control. The full-heat limit resistor must be adjusted to give full heat at 100 percent dial setting. This adjustment is similar to that described under spot-welding control.



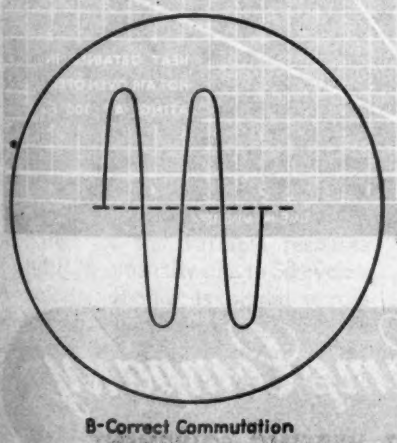


Fig. 4 — Scope traces, showing improper and correct commutation of electro-mechanical timer.

Electronic Timing

In the completely electronic seam-welding control, the mechanical timing circuit is replaced with electronic tubes (Fig. 5). The time settings may be changed by merely operating a switch or turning a dial while the mechanical timer requires rearranging of the buttons or segments to give the desired heat and cool times.

Timing Circuit

Similar to the spot-weld timing circuit, the seam-weld timing circuit usually operates from a d-c voltage. This voltage, obtained by rectifying the a-c line voltage, may be easily checked with a d-c voltmeter. The seam weld, being a series of heat and cool times, usually requires two separate timing circuits, one for the heat-time and the other for the cool-time. While these circuits may be identical, they are interconnected in such a manner that the termination of timing of one causes the other to be initiated. This "see-saw" action continues as long as the initiating circuit remains closed.

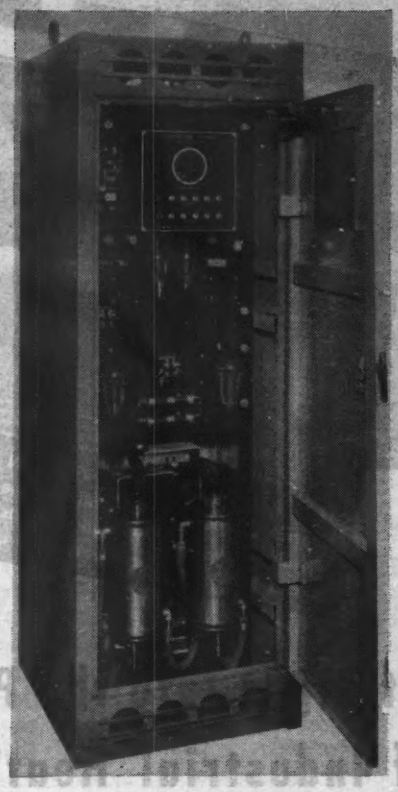


Fig. 5—An all electronic seam welding control.

A typical inverter timing circuit is shown in Fig. 6. The circuit includes two thyratron tubes and a vacuum tube. Tube No. 10 conducts during the cool time while tube No. 9 conducts during the heat or weld time. With the initiating switch open, tube No. 9 has no anode voltage. However, tube 10 becomes conductive as soon as the d-c voltage is applied. As long as the initiating switch remains open, tube 10 will continue to pass current. Ca-

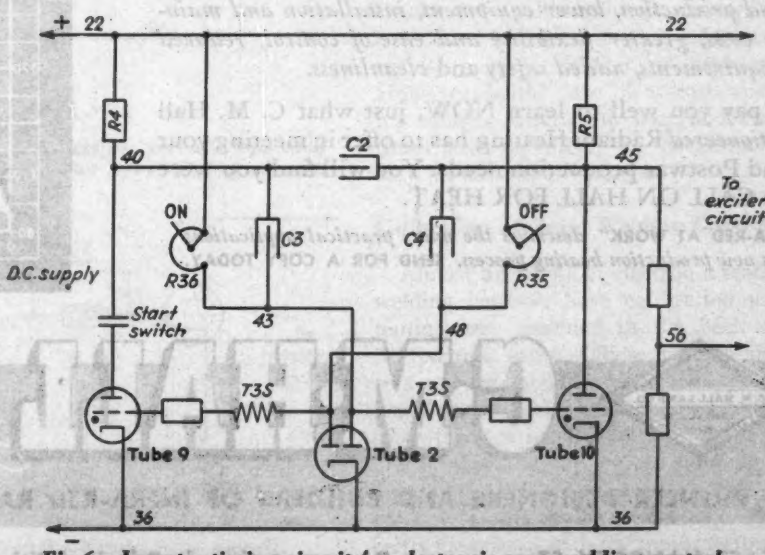


Fig 6—Inverter timing circuit for electronic seam welding control.

THIS RADIAIR OVEN IS VITAL IN WAR—VALUABLE IN PEACE
Wartime Uses—drying small airplane wing sections, large stampings, metal panels and semi-large flat parts. **Peacetime Uses**—drying name plates, bottle caps, lacquered paper ceramic dishware, panel surfaces.

Infra-Red
RADIANT HEATING IS A PRECISION PRODUCTION TOOL!

C. M. HALL *Radiair* OVENS

Fit Right Into the Production Line... Set New Standards of Industrial Heating ★ Drying ★ Baking ★ Dehydrating

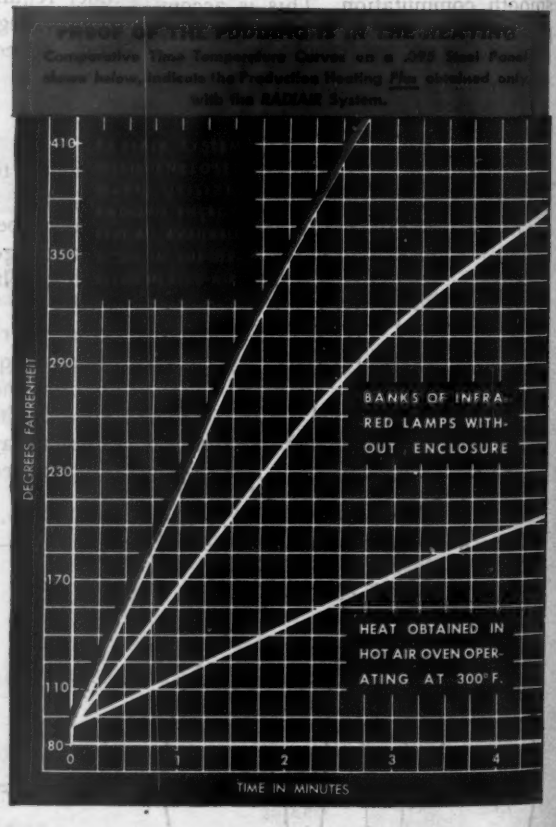
Old established methods of heat transfer and many conventional heating practices are being obsoleted by the increasing acceptance and use of infra-red radiant heating as a precision production tool. Meeting the complex demands of war production finishing has put infra-red radiant heating with its new techniques right into the production line, supplementing, complementing or taking the place of present heating equipment.

C. M. Hall RADIAIR Ovens always have incorporated the *time-saving benefits* of instant heat through radiant energy and the *extra-use value* of recirculated derived heated air to produce greater overall thermal efficiency.

The economies of RADIAIR heating vs. other heating systems cannot be made on a basis of unit-of-heat cost alone, since RADIAIR oven users find that many other advantages make it a real cost saver. These advantages include, *greatly increased production, lower equipment, installation and maintenance costs, greater flexibility and ease of control, reduced space requirements, added safety* and *cleanliness.*

It will pay you well to learn NOW, just what C. M. Hall *Productioneered* Radiant Heating has to offer in meeting your War and Postwar production needs. You will find you were wise to CALL ON HALL FOR HEAT.

"INFRA-RED AT WORK" *describes the many practical applications of this new production heating process.* **SEND FOR A COPY TODAY.**



C·M·HALL *Lamp Company*

PIONEER DESIGNERS AND BUILDERS OF INFRA-RED RADIANT HEATING EQUIPMENT

1033 EAST HANCOCK ST. ***Representatives in Principal Cities*** **DETROIT 7, MICHIGAN**

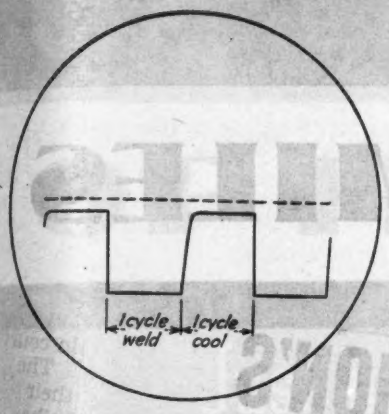


Fig. 7—Output voltage from inverter operating one cycle on and one cycle off.

pacitor C2 charges positive at 40 and negative at 45. Timing capacitor C3 charges positive at 40 and negative at 43 through the vacuum diode tube 2. The inverter circuit remains in this state until the initiating switch is closed, at which time tube 9 immediately conducts pulling point 40 down to 36. By virtue of the charges on capacitors C3 and C2, the anode and grid of tube 10 are driven negative with respect to the cathode 36, causing tube 10 to stop conducting.

The time constant of C2 and R5 is such that C2 discharges within a fraction of a cycle, thus returning the anode of tube 10 to a positive potential. The time constant of the grid circuit is determined by capacitor C3 and resistor R36. The resistor R36 being variable, enables the operator to vary the time constant of this circuit and thus vary the time required for the grid of tube 10 to return to a potential approximately equal to 36, and once again fires tube 10. The firing point in the cycle of tubes 9 and 10 is accurately controlled with a peak voltage imposed in the grid circuit of these tubes by transformer T3.

If the initiating switch remains closed, the action of tube 10 firing will be similar to above. By virtue of the charge on capacitors C2 and C4, the anode and grid of tube 9 will be driven negative, causing tube 9 to stop firing. The anode of tube 9 will return to a positive potential within a fraction of a cycle. However, the action of the grid is controlled by the time constant of capacitor C4 and resistor R35. The time range of the variable resistors R36 and R35 is usually one to 30 cycles.

A voltage divider is placed across tube 10 such that a d-c voltage may be inserted in the exciter circuit. This voltage is almost a square wave because of the action of tube 10. When tube 10 is conducting, the voltage between 22 and 56 is in the order of several hundred volts. However, when tube 10 is prevented from conducting (during the heat time), this voltage is reduced to approximately a tenth of that value. Thus, during the heat time the d-c voltage 22-56 is low, and during the cool time it is comparatively high. During a one-cycle heat and one-cycle cool seam-weld the voltage 22-56 will appear as in Fig. 7.

Exciter Circuit

The purpose of the exciter circuit is to supply a turn-on voltage to the firing tubes which is timed by the timing circuit. Also it is possible to introduce phase- or heat-control in this circuit. The typical exciter used with the described timing circuit consists of two thyratron tubes controlling the energy supplied to an impulse or peaking transformer (Fig. 8).

The inverter or timing circuit voltage 22-56 is connected to the grids of the exciter tubes. Imposed in the grid circuits is a phase-controlled peak voltage T2S (heat control). Similar to the spot-welding control, this phase-shift is accomplished with a resistor and capacitor from the supply voltage. During the cool time, the d-c voltage from the inverter is of such a magnitude that the peak will not allow the exciter tubes to fire. However, during the heat time this voltage is reduced to allow the peaks to cause conduction. The exciter tubes during the heat time energize T6 transformer from supply transformer T4. This excitation takes place in such a manner that impulse transformer T6 produces sharp peaks of the same polarity. This method of "shock" excitation also enables the phase relationship of these peaks to be controlled by the firing point of the exciter tubes, which is controlled by peak voltage T2 in the grid circuit of the exciter tubes.

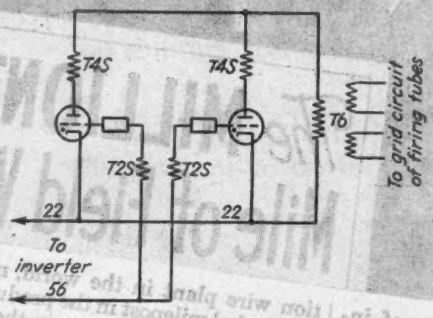


Fig. 8—Exciter circuit operated from inverter type timing circuit.

Firing Circuit

The firing circuit is employed to cause ignition of the ignitron tubes. Similar to the spot-welding control, a thyratron is used to control or fire each ignitron. The circuit of each firing tube is usually identical except that each is operating 180 degrees out of phase with respect to the other.

A typical firing circuit used with the above exciter and timing circuits is shown in Fig. 9. The grid voltage consists of the self-rectified bias derived from resistor and capacitor R19 and C7, a-c hold-off bias T5S, and the impulse turn-on voltage T6S. During the cool time no impulse is produced in T6S. However, during the heat time, a phase-controlled peak appears for the desired timing period and heat setting. The presence of this peak in the grid circuit of the firing tube causes conduction, which fires the corresponding ignitron or power tube.

The elementary diagram for a complete seam-welding control using the circuits described is shown in Fig. 10. While all seam-welding controls are not alike, the breakdown of the circuits in a manner similar to that described will be found very helpful in servicing other types of welding controls.

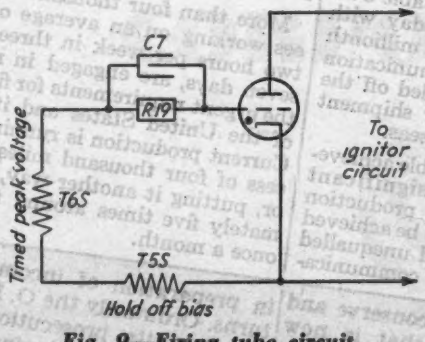


Fig. 9—Firing tube circuit.

Servicing

The method of servicing a seam-welding control is very similar to that of the spot-welding control. The service chart shown in that chapter may be used when servicing this type of seam-welding control equipment. When checking or calibrating the timing of a spot-welding control, it is necessary to use a cycle counter or recorder. However, in the case of a seam-welding control where the heat and cool times are repetitive, an oscilloscope may be used to advantage.

Calibration of Seam Welding Controls

Almost all forms of electronic seam-welding controls have calibration potentiometers mounted in the back of the control panel. These potentiometers are adjusted at the factory and usually are locked in position with some form of locking nut. If, because of failure of some part in the timing circuit, it is necessary to change a resistor, capacitor, or transformer directly associated with the timing action,

A MILLION MILES

GENERAL CABLE CORPORATION'S ST. LOUIS PLANT CELEBRATES RECORD WIRE PRODUCTION ACHIEVEMENT

More than twenty months of inspired war effort on the part of the Men and Women Employees of the St. Louis Plant of General Cable Corporation were crowned today with gratifying success when the millionth mile of critical field communication wire, single conductor, rolled off the production line ready for shipment to our armed forces overseas.

"This notable General Cable achievement, one of the most significant accomplishments in the production of a vital war material to be achieved in the St. Louis area and unequalled in performance in any communication wire plant in the world, marks an epochal milepost in the production of field wire which began in the local plant in October, 1943.

"More than four thousand employees working on an average of fifty-two hours per week in three shifts, seven days, are engaged in meeting the urgent requirements for field wire of the United States and its allies. Current production is running in excess of four thousand miles per day or, putting it another way, approximately five times around the globe once a month.

"In commenting on the production feat of the local organization, Mr. Dwight R. G. Palmer, President of General Cable Corporation stated, 'Though the performance of our St. Louis Plant was accomplished in the ordinary line of duty, Management nevertheless is particularly gratified that its personnel, comprising many races, creeds and colors, harmoniously evidenced their patriotic sincerity by establishing this outstanding record. We salute the Men and Women of our St. Louis Plant for this production achievement'.

a very great need to conserve and ... that is now ... in preparation of income tax returns. Ordinarily the O. P. A. must complete its prosecutions within ... year after bringing charges. ... company contrasts sharply ... the record of delays in the ... gram for production from ...

OF FIELD WIRE...

Just one example of General Cable's Service to the Nation and its Allies

This output of *one million miles of single conductor communication wire* for the armed services represents the *all-out* effort at only one plant producing enough wire to encircle the globe five times each month.

All ten General Cable plants have been working three shifts, seven days per week, on this and other essential military items.

Come final Victory, General Cable will as energetically attempt to do its part in winning the peace.

GENERAL CABLE CORPORATION

Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

Instruments FOR ALL PROBLEMS OF RECONVERSION

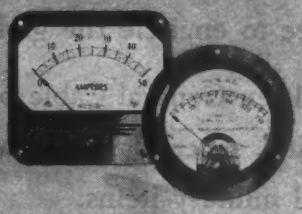
Utilities, manufacturers and maintenance contractors will find, within the broad WESTON line, instruments specifically suited to *all* problems of electrical reconversion . . . whether they involve quick repairs, rewiring for heavier loads, relocation of equipment, new testing stands or laboratory installations, improved lighting, as well as for all electrical and electronic maintenance needs. Literature, or engineering cooperation on any instrument problem, is freely offered. Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark 5, N. J.

(MODEL 785) INDUSTRIAL CIRCUIT TESTER . . . the most versatile portable tester for laboratories, and plant maintenance, where an ultra-sensitive instrument is required. Provides 27 AC and DC voltage, AC and DC current, and resistance ranges. (dc sensitivity 20,000 ohms per volt.)

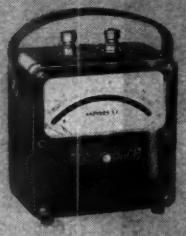
(MODEL 796) INSULATION TESTER . . . a direct-reading self-contained resistance tester that eliminates hand cranking. Tests up to 200 megohms at test potential of 350 to 500 volts dc., current at terminals only a few microamperes. Ranges 0-20-200 megohms, full scale . . . 0-5-5 center scale.

(MODEL 697) VOLT-OHM-MILLIAMMETER . . . combines a selection of AC and DC voltage, direct current, and resistance ranges in a pocket-size meter. Ideal for maintenance testing and inspection needs.

(MODEL 633) AC CLAMP AMMETER . . . for quick, easy current measurements on insulated or non-insulated conductors. The clamping jaws are simply clamped around the conductor, and readings taken. Circuits are never disturbed. A real time saver in electrical maintenance.



PANEL AND SWITCHBOARD INSTRUMENTS . . . available for all AC and DC requirements, in all types, sizes and ranges. The complete line is fully described in the WESTON Panel Instrument bulletin. Send for your copy.



(MODEL 430) AC AND DC TEST INSTRUMENTS . . . combine dependability, ruggedness, compactness and scale readability. Equipped with hand calibrated, mirror scales. Available for AC and DC requirements, and as DC and single-phase AC Wattmeters.

(MODEL 703) SIGHT METER . . . direct-reading, pocket size meter calibrated to measure light values in foot-candles, or by seeing tasks. Equipped with the WESTON VISCOR* filter, it measures all light values direct, without correction factors.

Weston Instruments

ALBANY • ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • JACKSONVILLE • KNOXVILLE • LOS ANGELES • MERIDEN
MINNEAPOLIS • NEWARK • NEW ORLEANS • NEW YORK • PHILADELPHIA • PHOENIX • PITTSBURGH • ROCHESTER • SAN FRANCISCO • SEATTLE • ST. LOUIS • SYRACUSE

In Canada, Northern Electric Co., Ltd., Powerlite Devices, Ltd.

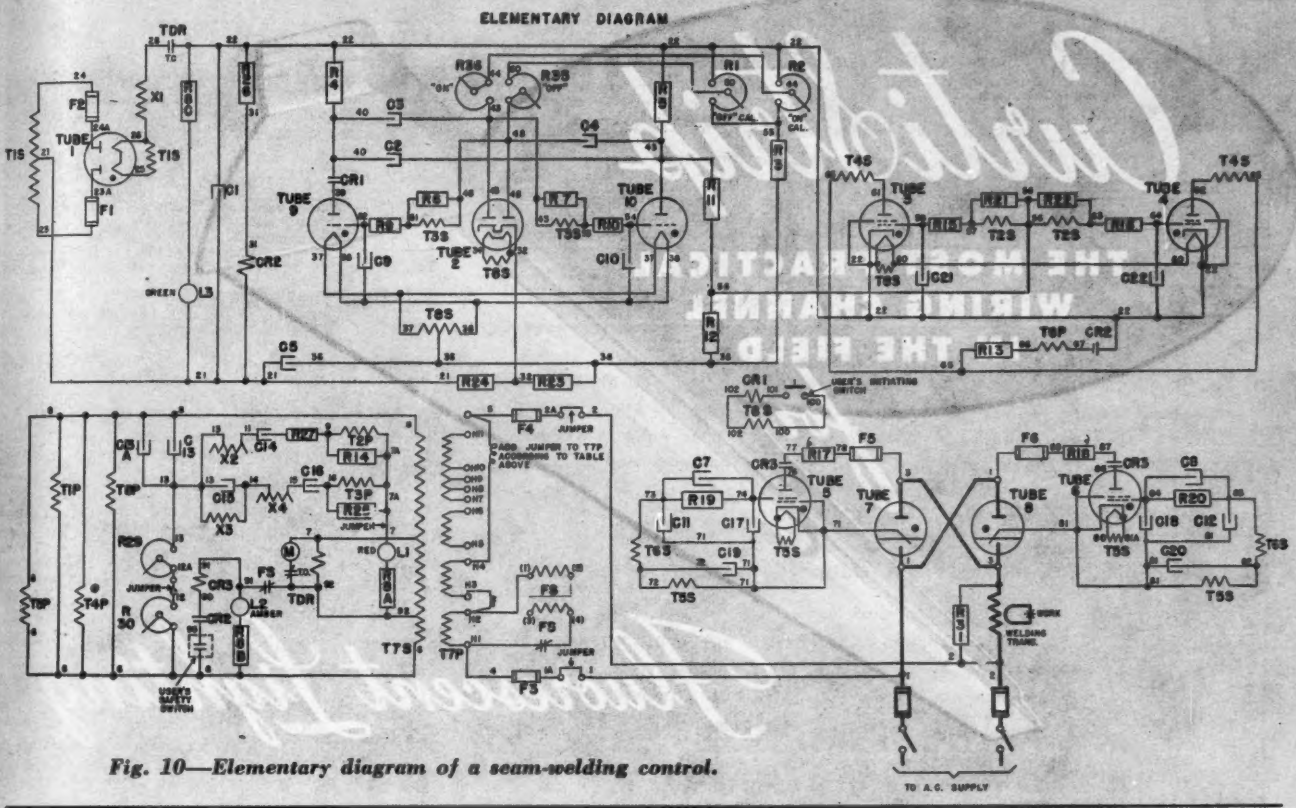


Fig. 10—Elementary diagram of a seam-welding control.

it is a good policy to check the calibration of the heat and cool time dials. This may be done with a reliable cycle counter or recorder, although accurate timing may be accomplished with a cathode-ray oscilloscope. While the counters and recorders are direct-reading, they are subject to error. A scope is exact and easy to read.

It is important that the scope should have a sweep circuit slow enough to permit synchronizing at least six cycles on the screen before the instrument can be used easily to calibrate timing ranges up to thirty cycles. Using this method, the heat and cool times are calibrated separately, and it makes no difference which is calibrated first. In those controls using a time sine-wave turn-on voltage, it is convenient to examine this voltage during calibration. Because all controls do not employ this method, the following description and illustrations are based on examining the voltage across the firing tubes, which is the same regardless of the timing circuit employed. In order to easily distinguish between the heat and cool time, it is suggested that the control be operated at 100 percent heat setting. The scope leads should be connected to the anode of each of the firing tubes, and six cycles synchronized on the screen of the scope to look like Fig. 11. Placing a copper bar between the electrodes of the welding machine will save material and give proper loading to the machine during calibration

First, the lower timing settings should be checked by actually observing and counting the number of cycles on the screen. One cycle heat and one cycle cool will appear as in Fig. 12. The cycle during welding is indicated by the straight line or tube drop during conduction. The OFF time is indicated by the sine-wave voltage and indicates that the firing tubes are not conducting. Three cycles heat and three cycles cool should appear as in Fig. 13, while two cycles heat and one cycle cool and one cycle heat and two cycles cool should appear as in Figs. 14 and 15, respectively.

It should be noted that the timing pattern will be steady and the heat time will appear at the same point on the screen after each OFF time. An unstable pattern will indicate that the panel is out of calibration. On these low time settings, it is easy to observe which one, or if both times are out of

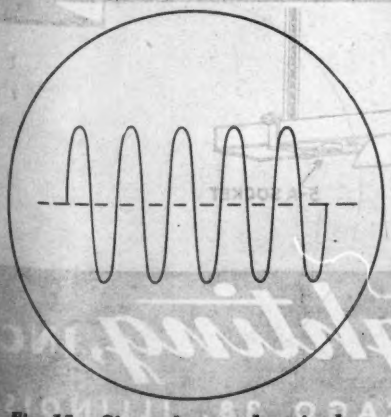


Fig. 11—Six cycles synchronized on oscilloscope screen.

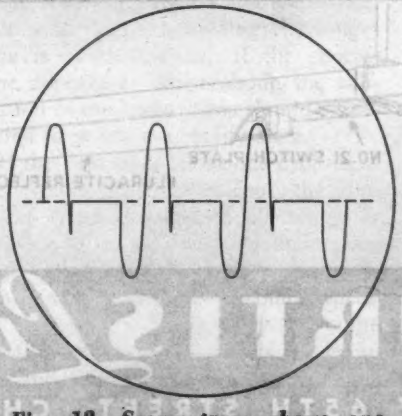


Fig. 12—Scope trace shows one cycle heat- and one cycle cool-time.

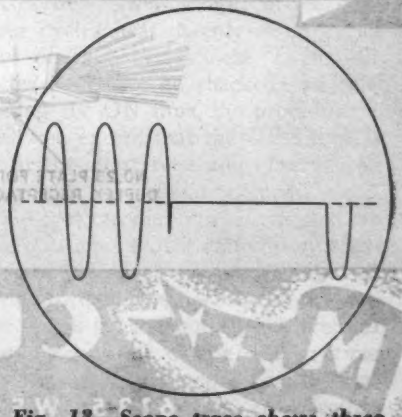


Fig. 13—Scope trace shows three cycles heat and three cycles cool.

AND A GREAT VARIETY OF OTHER APPLICATIONS

The electrical contractor who is familiar with the various uses of CurtiStrip has at his command scores of time and trouble-saving ways of installing lighting and other electric equipment. It is easy to figure your costs in advance when you use CurtiStrip and the finished job is neat and efficient.

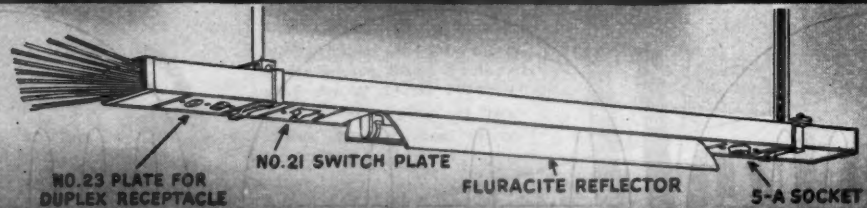
Primarily CurtiStrip is a large capacity wiring channel made with a patented snap-in cover plate, which is scored at 3" intervals and can be broken or cut to length and snapped into the lips in the channel.

Often used purely as a raceway it is a simple matter to install sockets or fittings on any spacing.

The fluorescent unit above shows one important CurtiStrip application . . . this material is ideal for either individual units or continuous line installation. Three reflector types . . . deep symmetrical . . . shallow symmetrical and asymmetrical permit adjustment to a variety of lighting tasks.

The sketch below shows the flexibility of CurtiStrip and how the convenient snap-in cover plate accommodates various fittings. Five different mounting hangers and brackets are available . . . again providing great flexibility in mounting. All in all there are so many advantages to CurtiStrip that it behooves you to write for complete data . . . today.

SKETCH SHOWS A FEW OF THE NUMEROUS CURTISTRIP FITTINGS



CURTIS Lighting, INC.

6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS

calibration. As long as the sum of the heat and cool times is equal to six and divisible into six, a synchronous pattern can be directly observed on the screen of the scope. In order to check timing combinations such as four and one, or two and three, it is necessary to synchronize five cycles, instead of six cycles on the screen. If time settings such as four and one, or two and three are examined on a six-cycle pattern, the position of the heat and cool times will not synchronize and appear to dance about, making it impossible to determine the exact timing and consistency of the heat and cool time intervals. With a five- or six-cycle pattern, it is possible to check all combinations from one cycle heat and five cycles cool to five cycles heat and one cycle cool.

Calibrating Longer Time Ranges

The design of most timing circuits is such that the lower dial settings remain in calibration regardless of the calibration potentiometer setting. Assuming the lower time settings have been checked on both the heat and cool time dials and found to be in calibration, the next step is to check the longer time settings. When calibrating the longer timing ranges, it is important to set the time range dial not being calibrated at some low setting, such as one, two, or three cycles. These low settings which have already been checked are easily viewed on a five- or six-cycle pattern on the scope.

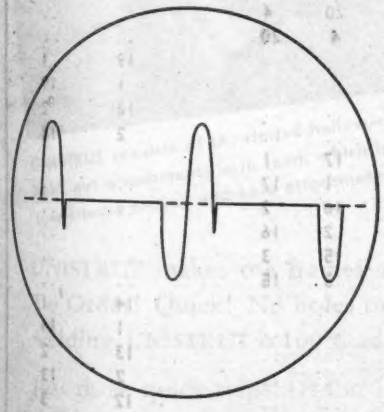


Fig. 14—Scope trace showing two cycles heat and one cycle cool.

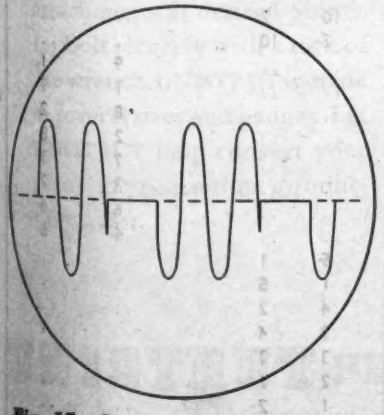


Fig. 15—Scope trace showing one cycle heat and two cycles cool.

If the sum of the heat and cool times is divisible by the number of cycles synchronized on the screen of the scope, a steady waveform of the shorter time will appear providing the longer time is in calibration. If the shorter time appears to dance about, the calibration of the longer time should be adjusted to produce a steady state.

If the control is set at one cycle heat and twenty-nine cycles cool, the sum of the times is equal to 30, which is divisible by five or six. Assuming the scope is adjusted for a five-cycle pattern, a steady waveform should appear on the scope. There may be some question as to whether this is one cycle heat and nineteen, twenty-four, twenty-nine, or thirty-four cycles cool, as all of these settings, divisible by five, would give a steady waveform. A check can be made by switching to a six-cycle pattern on the scope. If a steady waveform is still observed, the timing is one cycle heat and twenty-nine cycles cool as the total thirty is divisible by both five and six, while the total of the others is not. In a similar manner, settings such as two cycles heat, twenty-eight cycles cool, three cycles heat, twenty-seven cycles cool or four cycles heat, twenty-six cycles cool may be checked. In calibrating the ON time, the procedure is the same except that the OFF time is set at the short time and observed on the screen in a similar manner.

Most electronic timing circuits are so constructed that if calibration is adjusted at the longer time settings, all of the lower settings will be in calibration. It is a good policy, however, to spot check some of the shorter time settings to insure complete calibration. Table I will be helpful in selecting time settings which should produce

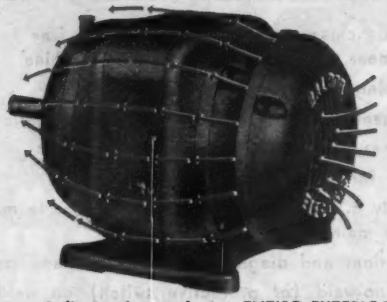
INSTALLATION TIPS
Electronic Resistance Welding Control

1. Mount control in a clean, accessible location; one free from excessive vibration and yet as near as possible to the welding machine.
2. Use conduit wiring throughout.
3. Connect equipment to a bus having the best regulation.
4. Ground all frames and enclosing cases.
5. Use clean water for cooling electronic tubes.
6. If separate supply is used for control power, be sure to maintain same phase relationship with main power.
7. Read all instructions and diagrams which accompany panel.
8. Locate a weld/no-weld (or protective switch) on welding machine convenient to operator. See panel wiring diagram for proper circuit in which switch should be connected.
9. Be sure to allow necessary preliminary heating on all of the larger mercury type, hot-cathode tubes.
10. Keep a service record of each control and all tubes contained in the control.

SERVICING TIPS
Electronic Resistance Welding Control

1. Make "Safety First" the rule when working on controls with power applied.
2. From the action of the control, try to confine fault to a particular circuit.
3. Check tubes by inserting tubes known to be good, or by exchanging a questionable tube with another similar tube in the control.
4. Examine control for smoking or burned parts.
5. Check all fuses.
6. Check action of all relays and interlocks. Keep contacts clean.
7. When taking measurements or working on control with power applied, remove ignitor fuses to avoid energizing welding transformer.
8. Measure a-c sine-wave and d-c voltages with a reliable voltmeter.
9. Examine timing and pulse-, or peak-voltage with a cathode-ray oscilloscope. Be sure scope has been properly modified to read d-c voltages.
10. Avoid connecting voltmeters or scopes directly to the grid of a thyratron tube.
11. When checking resistors and capacitors, be sure to isolate them from other circuits.
12. Check movable or adjustable switches, resistors, or capacitors for worn or dirty contacts.

THE MOTOR for MANY APPLICATIONS



Arrows indicate air travel over ENTIRE EXTERIOR of BALDOR STREAMCOOLED Motor

BALDOR STREAMCOOLED MOTOR

This ALL-PURPOSE MOTOR will simplify your Designing, Purchasing, Production and Inventory. Check these features with your motor specifications:

1 Totally enclosed — ball bearing.
2 Drip-proof; splash-proof; grit-proof; lint-proof.
3 Horizontal, vertical and side wall mounting.
4 Removable base.
5 End plates interchangeable for face mounting.
6 Standard NEMA dimensions.
7 Standard or glass insulation.

BALDOR ELECTRIC COMPANY, St. Louis 10, Mo.

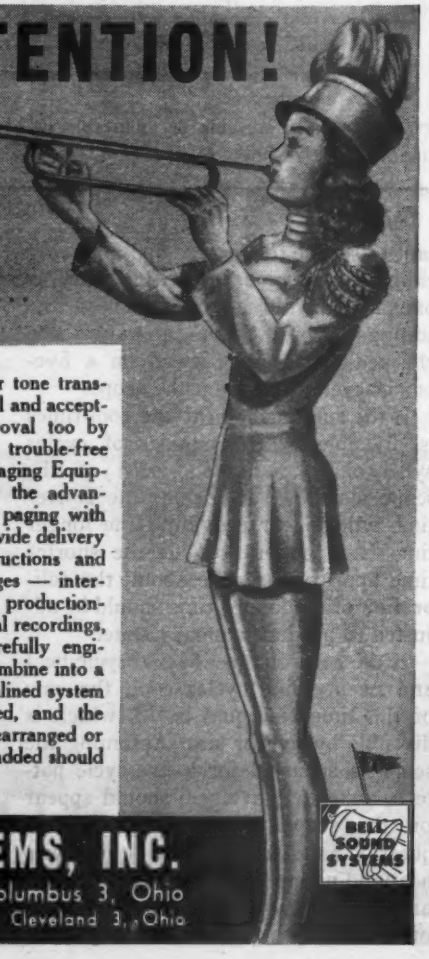
District Offices in Principal Cities

INSTANT ATTENTION!

with BELL

Voice-Paging Equipment

SPEEDY VOCAL PAGING.....
NEWS and MUSIC BROADCASTS...
TIME and ALARM SIGNALS



Compact, "matched-unit" construction, ultra-clear tone transmission and attractive price, gain instant approval and acceptance for BELL Voice-Paging Equipment. Approval too by installation and maintenance men because of trouble-free operation and ease of servicing. BELL Voice-Paging Equipment combines the advantages of vocal paging with speedier plant-wide delivery of news, instructions and special messages — interspersed with production-speeding musical recordings, if desired. Carefully engineered units combine into a compact streamlined system to fit any need, and the units may be rearranged or matching units added should needs change.

BELL SOUND SYSTEMS, INC.

1196 Essex Ave., Columbus 3, Ohio
Export Office: 4900 Euclid Ave., Cleveland 3, Ohio

steady waveforms if the control is in calibration.

The oscilloscope method of checking the timing of a seam-welding control may seem rather lengthy and complicated. Facility comes with practice. Servicemen familiar with this method prefer it to the other means of checking timing.

TABLE I

Typical dial setting used for completely checking calibration of seam-welding controls with cathode-ray oscilloscope

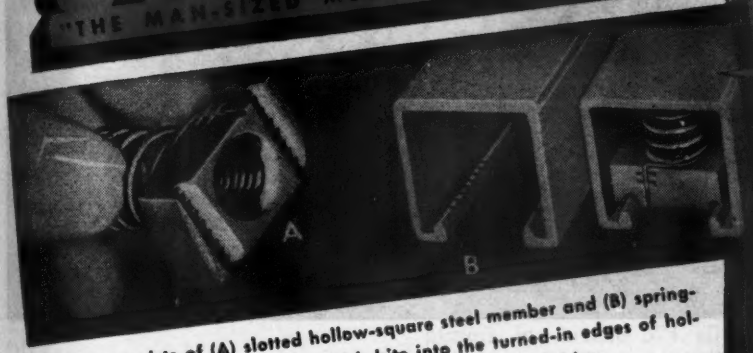
Scope Synchronized for 6-Cy. Pattern		Scope Synchronized for 5-Cy. Pattern	
Weld Time	Cool Time	Weld Time	Cool Time
29	1	29	1
1	29	1	29
28	2	28	2
2	28	2	28
27	3	27	3
3	27	3	27
26	4	26	4
4	26	4	26
25	5	..	..
5	25	..	..
..	..	24	1
..	..	1	24
23	1	..	..
1	23	..	..
22	2	..	..
2	22	..	..
21	3	..	..
3	21	..	..
20	4	..	..
4	20	..	..
..	..	19	1
..	..	1	19
..	..	18	2
..	..	2	18
17	1	..	..
1	17	..	..
16	2	..	..
2	16	..	..
15	3	..	..
3	15	..	..
..	..	14	1
..	..	1	14
..	..	13	2
..	..	2	13
..	..	12	3
..	..	3	12
11	1	..	..
1	11	..	..
10	2	..	..
2	10	..	..
..	..	9	1
..	..	1	9
..	..	8	2
..	..	2	8
..	..	7	3
..	..	3	7
..	..	6	4
..	..	4	6
5	1	..	..
1	5	..	..
4	2	..	..
2	4	..	..
3	3	..	..
2	1	..	..
1	2	..	..
1	1	..	..

Speed Up Reconversion

Right on the job, and in jig-time, build all kinds of supports and frames for electrical equipment with

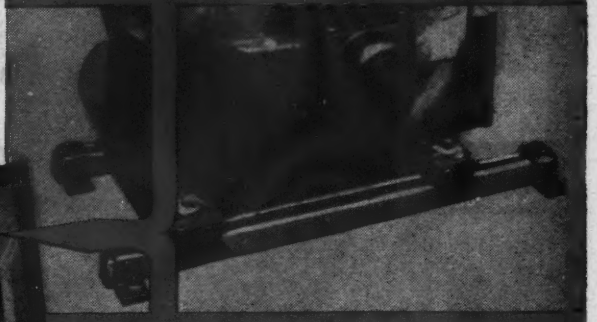
"UNISTRUT"

"THE MAN-SIZED METAL BUILDING SET"



UNISTRUT consists of (A) slotted hollow-square steel member and (B) spring-held nut attachments with teeth which bite into the turned-in edges of hollow-square section and hold attachments in any desired position.

Need supports for cables or wiring—Quick? It's a snap when you use UNISTRUT!

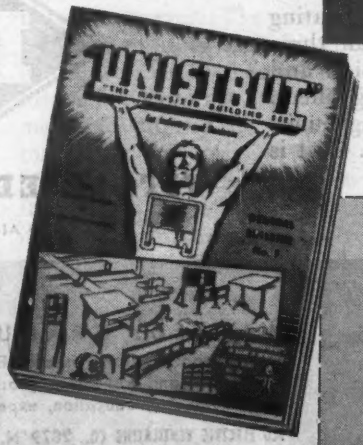


Need motor bases—Quick? Or supports for electrical instruments or equipment? You can have them, pronto, with UNISTRUT!

Need new stock racks—Benches—Machine supports—Quick? UNISTRUT is the answer!

UNISTRUT makes the frames and supports you need! To Order! Quick! No holes to drill. No riveting. No welding. UNISTRUT is 100% adjustable, 100% reusable.

Just three quick steps! (1) Cut UNISTRUT to desired length with a hacksaw. (2) Locate attachments at desired points. (3) Bolt securely with a turn of the wrench. UNISTRUT is made in several sizes and gauges. Let UNISTRUT help convert your plant for peace-time production—fast.



Get Free Booklet

Send This Coupon!

Learn about this wonderful way to speed reconversion. Free General Bulletin shows over a hundred applications. Fill out and mail.

Name .....

Company .....

Address .....

City ..... State .....

EC 7/45

1226

THE MAN-SIZED METAL BUILDING SET

UNISTRUT PRODUCTS CO.

1013 W. Washington Blvd. • Chicago 7, Ill.

HAVE YOU TRIED ILG *FLOATED DRIVE?*

Simple, compact arrangement of ILG direct-connected motor and wheel unit with "Floated Drive".

Motor and Wheel "ride in rubber" for effective, low-cost sound isolation!

Extremely quiet operation is yours with ILG patented "floated drive"! This tried and proved ILG development eliminates metal-to-metal contact, isolates sound and vibration *at point of origin*, prevents noise amplification by fan housing. Four point vertical floating of the weight takes advantage of all three loading factors—compression, tension and shear—providing utmost dampening effect. Motor and wheel are isolated as a single unit. Unbalanced cushioning is impossible. Cost is low—installation is quick and simple—results are highly satisfactory. Can be mounted at any time on Centrifugal Fans. Write us or call nearby Branch Office (consult classified directory) for complete information.

ILG

VITALIZED VENTILATION

AND AIR CONDITIONING

FREE!
88-page book on solutions to ventilating problems.

WANTED: GRADUATE ENGINEERS!
for ILG Branch Offices, Research, Engineering Depts. Exceptional opportunities now and post-war for graduates of accredited technical schools. Send details on education, experience, health, age, marital status.

ILG ELECTRIC VENTILATING CO., 2879 N. Crawford Avenue, Chicago 41, Ill.
Offices in 40 Principal Cities

Answered by
F. N. M. SQUIRES
Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.
and
GLENN ROWELL
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

QUESTIONS ON THE CODE

SUB-DIVIDED RANGE CIRCUITS

Q. *"Rule 2174 of the Code requires that ranges rated at over 16 kw., shall have sub-divided circuits which shall be protected at not over 50 amperes. Where are these protective devices to be installed, in the range, or are the circuits to be divided before entering the range?"*—T.R.

A. The only practical method is to sub-divide the circuits *in* the range and to have the protective devices in or on the range itself.

Also these circuits must be divided by the manufacturer before the range leaves the factory as otherwise the Laboratories could not list the appliances as meeting the requirements of the Code. Of course any alteration to an approved appliance after leaving the factory, may upset its approval.—F.N.M.S.

UNDERGROUND WIRING

Q. *"We recently purchased several coils of No. 10 to No. 6 wire insulated with a type SNW insulation and were told that this wire could be buried directly in the earth. Upon comparing this wire with SNW wire manufactured by other companies, we noted that the insulation was half again as thick. Will the use of this be permitted by the Code?"*—H.H.

A. The use of underground wiring controlled by the National Electrical Code is limited to services to buildings. Section 2311 states that underground service conductors must be protected against mechanical injury by being installed in duct, conduit or in the form of a cable especially approved. Service conductors approved for use underground without requiring the protection afforded by a conduit or duct are known as type USE conductors. Type SNW or TW conductors are approved for use underground but only when installed within a raceway.—G.R.

SURFACE RACEWAYS

Q. *"Does the Code limit or restrict the use of surface raceways, or metal moulding for surface installations in existing buildings such as office buildings or department stores?*

"We believe that metal moulding is used extensively in the United States for surface installations. Is this correct?"—J.A.W.

A. The Code does place some restrictions on the use of surface raceways. For instance, rigid conduit has some restrictions, according to occupancies, in Section 3462 and as to use in wet locations in section 3464; electric metallic tubing has certain restrictions in 3482; likewise there are certain restrictions on flexible metal conduit in section 3502. Surface metal raceways as mentioned in Article 352, wireways, as covered in Article 362, busways in section 364 and auxiliary gutters in Article 374 all have restrictions placed about their use. All of these above devices may be used as surface raceways.

Metal moulding is used quite extensively in the United States for surface raceways. It is particularly well adapted for use in finished buildings and especially in offices and stores. The restrictions on its installation and use are not severe. The most important ones where it is used in offices and stores are that it be used only in dry locations, where not subject to severe mechanical injury, for voltage of motors 300 volts unless a heavy gauge metal is used, where wires not larger than No. 6 are used, and where not more than ten wires are involved. It may be run through dry walls, if in unbroken lengths.—F.N.M.S.

EXTENDING LEADS ON SOCKETS

Q. *"We recently received a shipment of weatherproof sockets wired with three inch leads. Will it be permissible to extend these leads with solid No. 14 wire as they are not long enough to attach to the circuit conductors run on each side of the floor joists in the average cattle barn?"*—L.C.M.

A. The conductor between the support and the socket must be of the stranded type. This requirement may be found under Section 4106-a of the National Electrical Code, which reads as follows: "Pendent lampholders with permanently attached leads, if used in other than festoon wiring, shall be hung from separate stranded rubber covered conductors which are soldered directly to the circuit conductors but supported independently thereof. Such pendent conductors shall not be smaller than No. 14 for mogul or medium base lampholders." Therefore, if the present three inch leads are too short, it will be necessary to extend them with No. 14 stranded conductors.—G.R.

GROUNDED CONDUCTORS

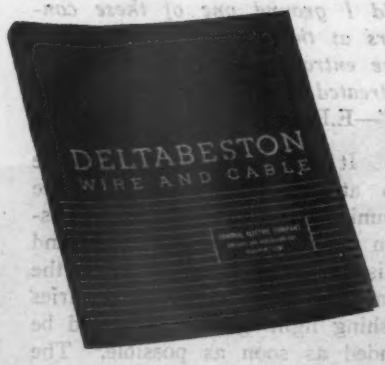
Q. *"Our town is supplied by a municipally owned generating plant, and the distribution system does not in all instances contain an identified neutral. In some of the older parts of town no attempt has as yet been made to revamp the transformer connections and provide an identified grounded conductor with the secondary distribution. Should I ground one of these conductors at the service or should all service entrance conductors be fused and treated as ungrounded conductors?"*—E.P.

A. It seems that some definite attempt should be made to force the municipal authorities having jurisdiction over the generating plant and the distribution system to correct the present condition. All secondaries furnishing lighting service should be grounded as soon as possible. The National Electrical Code under Section 2514 states that secondary alternating current systems supplying interior wiring, and interior alternating current

When heat bakes out the insulation on your wiring, power fails and motors stop running. These failures can be serious. Particularly if they occur when plant operations are at peak load. Don't risk power failures with ordinary cables. Rely on a cable that meets the torrid test. Use Deltabeston. It's designed to resist intense heat . . . just the cable you need for power, lighting and control circuits in torrid zones.

The Deltabeston Power Cable illustrated here is a three-conductor Type AVA recommended for installations in conduit or exposed wiring. It is only one of more than a hundred different wires and cables in the Deltabeston line. There's a Deltabeston Cable for every installation where heat, flame, moisture, oil, grease and corrosive vapors are a problem.

Deltabeston Power Cable Types AVA or AVL are ideal for wiring in power plants, boiler rooms, steel mills and in other installations where constant high temperatures prevail. It is insulated with felted asbestos, varnished cambric insert and asbestos braid or lead sheath over-all.



Here's the answer to your wiring problems. You can obtain a copy by writing to Section Y752-8, Appliance and Merchandise Department, Bridgeport, Connecticut. Deltabeston Wires and Cables are distributed nationally by Graybar Electric Company, G-E Supply Corp., and other G-E Merchandise Distributors.

BUY WAR BONDS AND KEEP THEM

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

GENERAL ELECTRIC

wiring systems, shall be grounded if they can be so grounded that the maximum voltage to ground does not exceed 150 volts. If some of the transformers supplying secondary systems in your town are not grounded and the secondaries do not contain an identified conductor, compliance with the Code on the part of a person wiring the ordinary dwelling may result in transformer burnouts.—G.R.

CONTROL AND POWER WIRES IN SAME CONDUIT

Q. *"Is it permissible to run a three conductor thermostat cable or a signal cable of two conductors that is part of the secondary circuit of a 110 volt/24 volt a-c bell transformer in the same conduit as the 110 volt a-c line that serves the oil burner controls and motor?*

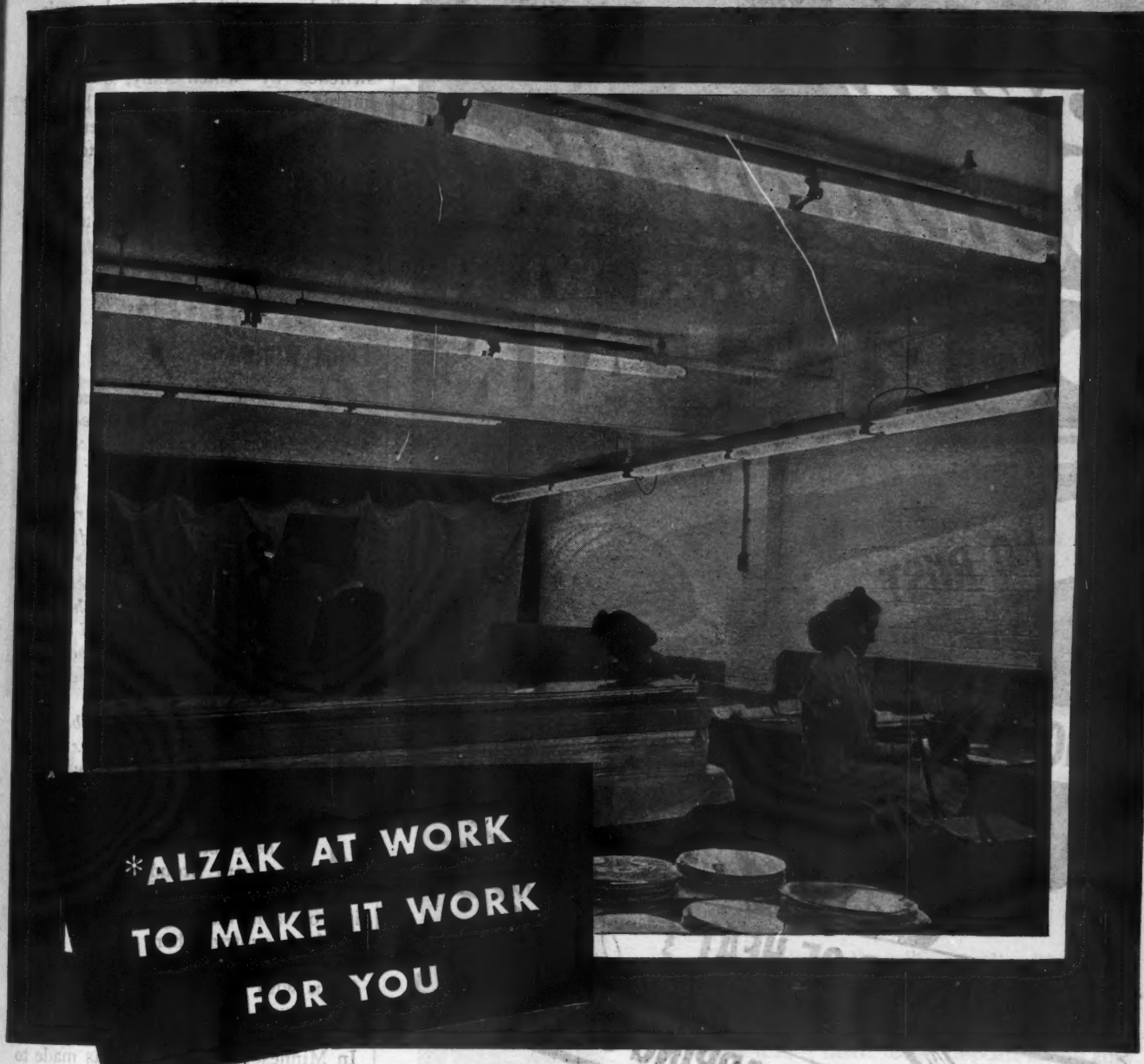
"We run into this in domestic oil burner installation work. Sec. 321 of the Code seems to prohibit this."—F.J.M.

A. The Code requires that conductors of different systems—that is those having different sources of current—when occupying the same raceway, shall have insulation on all of the wires suitable for the highest voltage used in the raceway. Therefore if the thermostat or signal wires are in the same circuit with the 110 volt wires, they shall be insulated for the 110 volts. This means that they must have insulation for at least 300 volts and probably have 600 volt insulation. There is no approved "thermostat" cable.—F.N.M.S.

DEMAND FACTOR ON MOTOR INSTALLATION

Q. *"I have the installation of several motors for a pumping system, but the system is such that all of the motors and pumps cannot be used at the same time. The most at any one time would be one-half of the total installed. In figuring the feeder supplying all of the motors must I provide sufficient carrying capacity for all of the motors or may I figure only for those which will be running at any one time?"*—H. S.

A. Section 4316 of the Code permits the use of a demand factor where the authority having jurisdiction can be convinced that all of the motors are not operating at one time. Each such case should be



*ALZAK AT WORK TO MAKE IT WORK FOR YOU

● Alzak-finished aluminum reflectors, naturally, get the job for final inspection of Alcoa aluminum reflector sheet before it goes to the reflector manufacturer.

Maximum efficiency, long life and low maintenance cost are the advantages of Alzak-finished lighting reflectors. Year after year they retain their high reflectivity. The glasslike, hard oxide coating guards against chipping and makes the surface easy to keep clean.

Alzak reflectors can be finished for indoor and outdoor work, for spot illumination and diffuse. Your reflector manufacturer can furnish you with the type of Alzak finish for any special lighting job.

ALUMINUM COMPANY OF AMERICA, 1946 Gulf Building, Pittsburgh 19, Penna.

*Registered trademark

ALCOA ALUMINUM

● Long-life durability is a big advantage of PORCELAIN Protected Wiring! It outperforms other wiring systems because the material used in this modern method of knob-and-tube wiring is not subject to deterioration by rust, corrosion, confining of heat, trapping of water, and similar hazards of age and weather. The nonmetallic way is the time-proven way for safe, economical, durable wiring. Ask your friendly Electric Inspector about the safety features of knob-and-tube wiring. Write for wiring manual.

PORCELAIN PRODUCTS, Inc.
FINDLAY, OHIO

Wire Today for Tomorrow's Load

handled separately by special permission in writing. One rather sure and safe way is by the use of selector switches by which only a certain limited number of motors may be used at once. In the case, as mentioned above, only one-half of the motors are to be used at once, the most simple form of selector switches to use would be the double throw switches.—F.N.M.S.

FARM WIRING

Q. *Several years ago we wired a number of farms connected to an REA line. All materials used were of the approved type and to our knowledge at that time were suitable for use on farms. For the past year or so we have received one complaint after another from the owners of these farms because of the way the switch cabinets are rusting. It has now reached the stage where we feel obligated to replace these switches at our expense in order to gain the goodwill of the farmers. Why did the Code ever permit such unsuitable equipment to be used on farms? Are there switches available today which will not become rusty within a couple of years?*—A.K.

A. The electrical industry cannot be very proud of the wiring materials made available for the wiring of farm buildings in those areas of this country where winter means cold weather. We tried to wire these farms with materials designed for urban wiring in spite of the experience previously gained in packing houses. In Minnesota an attempt was made to prohibit the use of any cabinet in buildings housing livestock that was not protected against corrosion by a corrosion resisting plated finish. Manufacturers of switches and local contractors together with farm organizations brought so much pressure to bear that this provision of the State Wiring Regulations could not be enforced. The National Electrical Code was not at fault as the 1940 edition under Section 3717 definitely prohibited the use of enameled boxes or cabinets within a severely corrosive atmosphere, and in the fine print note below this section stables were included among the occupancies likely to contain a corrosive atmosphere. Personally I do not believe that metal plating is the proper answer as the scratch of a workman's tool is all that is necessary to permit corrosion to ruin the best type of device, but it is the only method now in use which will assure a normal useful life provided the protective

NATIONAL ELECTRIC PRODUCTS

NE

WIRING 6 SYSTEMS

WIRES AND CABLES

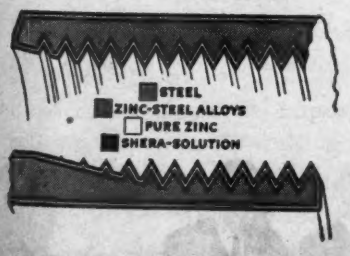
Sherarduct

RIGID STEEL CONDUIT

Unsurpassed for Satisfactory Service

NATIONAL ELECTRIC SHERARDUCT

- IS MORE HIGHLY RESISTANT TO MOISTURE AND CORROSIVES.
- BENDS MORE READILY.
- FABRICATES INTO THE JOB EASIER.
- "LASTS AS LONG AS THE JOB."



Cross-section of Sherarduct

NE Sherarduct (rigid steel electrical conduit) is easily installed and gives excellent performance on the job. These qualities are inherent in the conduit since it is subjected to two important processes. First the metal is "Spellerized" to produce a pipe which works more smoothly, bends easier and threads cleaner.

The conduit is then "Sherardized"—a process pioneered by National Electric over thirty years ago. Through "Sherardizing" zinc dust is driven into the pipe and applied to the surface under heat. Even deposit of the zinc gives a uniformly smooth surface, over which is applied Shera-solution which impregnates the zinc. Sherarduct is unsurpassed in its protection against rust and corrosion.

The craftsmanship in this conduit is illustrated by the coupling. The tapered threads provide strong, close union which keeps out corrosion. For complete information write for our 350 Page Engineering Data Book—free.

CONDUITS, RACEWAYS, WIRES AND CABLES FOR EVERY ELECTRICAL PURPOSE.

National Electric PRODUCTS CORPORATION

• Aerovox is still the pioneer—with a simple and profitable solution of the wartime servicing problem. You can now service those wornout motor-starting capacitors and keep old refrigerators running with Aerovox universal replacements.

Only 28 universal numbers—22 for 110-volt, 6 for 220-volt—take care of upwards of 90% of all motor-starting replacements. Handy Aerovox conversion chart indicates proper universal type for any previously available type. Minimum stock: maximum service.

Ask Your Jobber...

• Ask for Aerovox motor-starting capacitor replacements. Ask to see the Aerovox conversion chart. Or write us direct.

AEROVOX Capacitors
INDIVIDUALLY TESTED
AEROVOX CORP., NEW BEDFORD, MASS., U. S. A.
In Canada: AEROVOX CANADA LTD., HAMILTON, ONT.
Export: 13 E. 40 St., New York 16, N.Y. Cable: "ARLAB"

coating is not injured. Experience has indicated that one sure method of getting around the corrosive conditions is to mount these switch cabinets outdoors on the building wall adjacent to the doorways, then by using rain-tight enclosures or by providing a weather shelter for ordinary cabinets even the enameled cabinets seem to resist corrosion fairly well.—G.R.

DISCONNECTING SWITCH FOR RANGE CIRCUIT

Q. *I have just completed rewiring a rather large home occupied by one family. The total connected load was sufficient to require a 200 ampere service switch. Now the inspector wants a special 60 ampere rated switch mounted alongside the service switch to act as a disconnect switch for the range circuit. Is it not true that the Code accepts a service switch as a disconnect for a range?*—H.G.L.

A. Yes, in a single family dwelling the National Electrical Code under Section 4241-e does permit the use of the service switch as the disconnecting switch of an appliance rated over 1650 watts. It would seem that this might be rather inconvenient even though permitted by the Code.—G.R.

INTERLOCKED SWITCH

Q. *"Does Section 2440 of the 1940 Code mean that only type A switches may be used as motor disconnect switches or can a fused horsepower rated switch be used even if there is no interlock on door?"*—W.J.W.

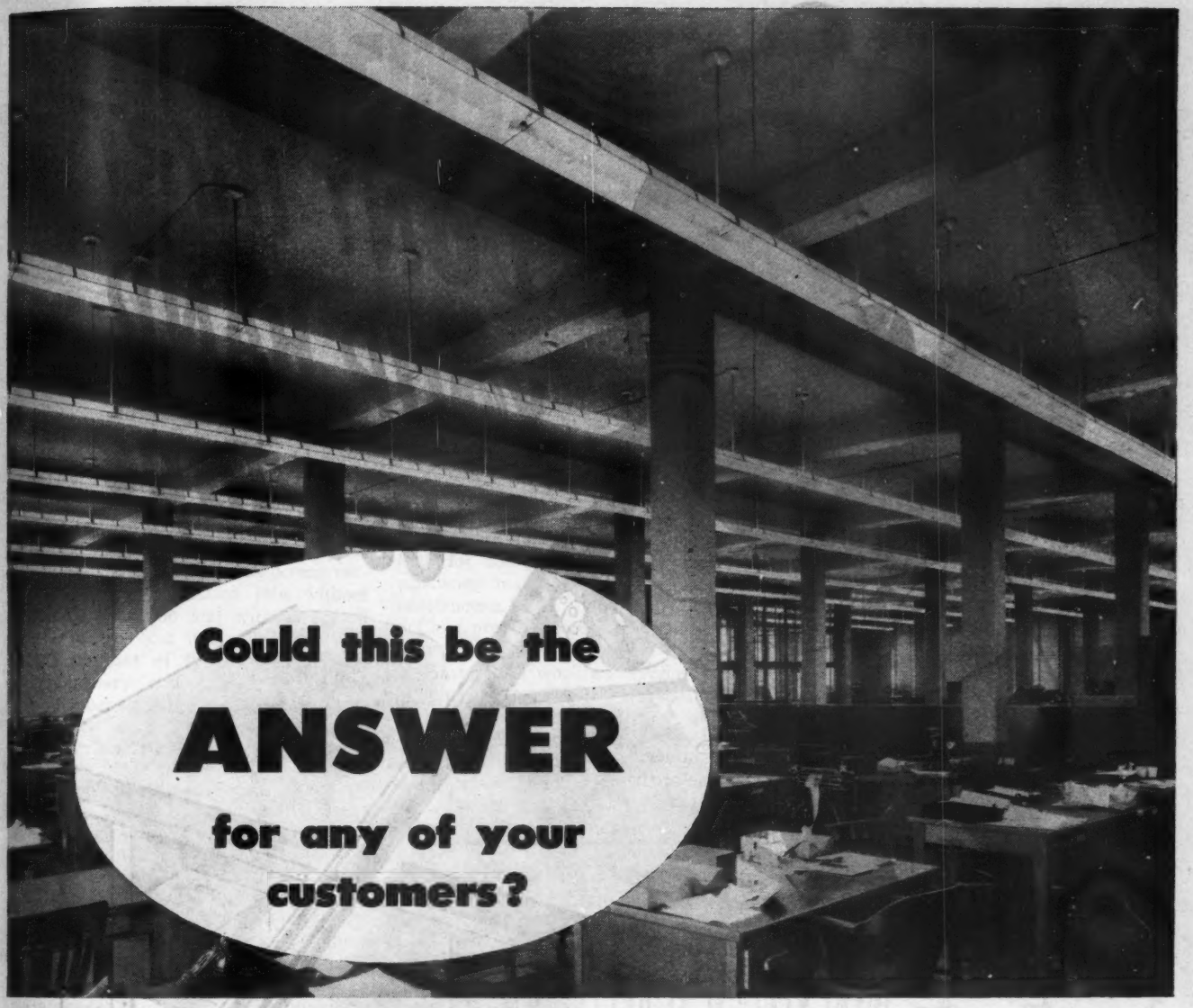
A. The Code does not mention "Type A" switches, nor does Section 2440 mean that only an enclosed switch with an interlock on the door can be used on circuits of over 150 volts to ground. The intent of the rule is that on circuits of over 150 volts to ground and where they are accessible to other than qualified persons, fuses and thermal cutouts must have independent disconnecting means so that they could be disconnected from their source of supply before being touched. However, if the person who wants to change a fuse did not choose to disconnect it before touching it, that matter would be his own responsibility. At least provisions would be made for him to do so.—F.N.M.S.

FIXTURES FOR HAZARDOUS AREAS

Q. *Are there any lighting fixtures approved for use in an acetylene generator house?*

A. At the time this is being written, there are no approved lighting fixtures suitable for use in a Class I Group A location; however, in all probability such a fixture will soon be available as several manufacturers are now at work on the development of such equipment. Until such time as approved fixtures are available, it might be advisable to light an acetylene generator building by means of rain-tight equipment mounted outside the building with light directed through windows and/or skylights.—G.R.

Kansas City E.M.E. notables at recent meeting were (L to R) T. F. McGurn, vice-president of the Electrical Maintenance Engineers of Greater Kansas City (Mo.) and chief electrician, Board of Public Utilities, Kansas City, Kansas; T. B. Fitzmorris, E.M.E. president and chief electrician, General Mills, Inc., Kansas City, Mo.; W. M. Hand, G.E. Co. (retired); H. H. Kuhn, president, Electric Association of K.C. and vice-president, Kansas City Power & Light Co.; Ray Green (guest speaker) Fostoria Pressed Steel Corp., Fostoria, Ill.; M. J. Cleary, Fostoria Industrial Service, St. Louis. A record crowd of 250 members and guests assembled to hear Ray Green discuss infra-red applications in wartime and peacetime production.



Could this be the ANSWER for any of your customers?

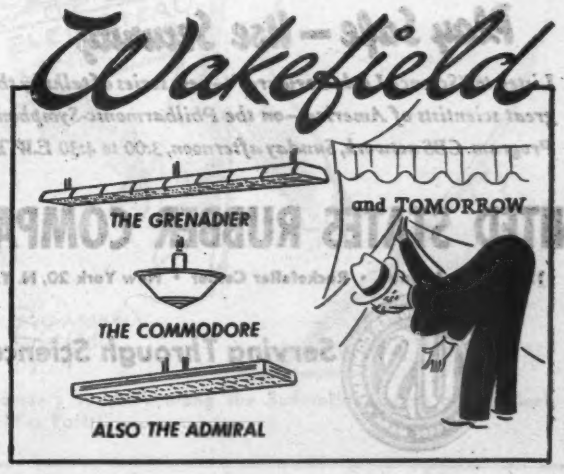
Office Problem:
Paper work volume increasing but errors increasing, too! Management question—how can work be handled with fewer errors?

Indicated Solution:
Better lighting . . . but . . .

Limitations:
Rewiring difficult or impossible because of reinforced concrete ceilings. Outlets inadequate in number. Heavy beams that complicate structural changes.

How It Was Solved:
Wakefield was asked to make recommendations for better lighting. You see the result above. Continuous rows of GRENADIERS (PG2488) provide more light on work and better light throughout the office. (Properly lighted walls and ceilings, plus light on work, mean greater eye comfort, less eyestrain.) GRENADIERS make it easy for existing outlets to handle the job without a "forest of rewiring" because *they provide their own wireway to carry feed wires.* Wakefield's adjustable hangers facilitate installation; make small ceiling irregularities no problem. Result: six months later an average of 35 footcandles on desktops.

Perhaps there's a suggestion in this for you and your customers. Wakefield will be glad to work with you on lighting for office or drafting room. The F. W. Wakefield Brass Co., Vermilion, O.



Safety Tip— Even with a heavy glove, your hand takes a beating when gripping a hard star drill. Try wrapping the drill handle with U.S. Security Friction Tape, and you won't sting your hand. Safe, sure, long-lasting Security Tape can give you lots of help on countless jobs in factory and home.

Play Safe—Use Security

Listen to "Science Looks Forward"—new series of talks by the great scientists of America—on the Philharmonic-Symphony Program. CBS network, Sunday afternoon, 3:00 to 4:30 E.W.T.

UNITED STATES RUBBER COMPANY

1230 Sixth Avenue • Rockefeller Center • New York 20, N. Y.

Serving Through Science

IN THE NEWS

CONSTRUCTION CONTROLS RELAXED BY WPB

The first step in relaxation of control over construction activities, effected by Order L-41 as amended, was announced recently by the War Production Board.

Chief changes made by the amended order are the raising of the annual dollar value limits on various types of construction that may be undertaken without WPB authorization, and expansion of other exemptions from the provisions of the order. These exemptions permit certain types of construction jobs without WPB authorization and without regard to the annual cost limits. One of the most important of the new exemptions is preliminary earth-moving operations if no lumber or other construction materials except drainage pipe are required.

In a statement explaining why controls on construction cannot be lifted completely at the present time, John L. Haynes, director of WPB's Construction Bureau, said:

"The construction industry is one of the largest potential users of resources and one of the largest potential employers of manpower. It is therefore a key industry in the partial reconversion made possible by V-E Day, and as such it should operate under as much freedom as possible. Unfortunately, lumber and many other construction materials are expected to remain in short supply for some time, and manpower is not yet available in many areas. These factors, and the necessity of maintaining war production, make it impossible to remove all construction controls now.

"Controls will be relaxed just as soon as resources become available, but relaxation will have to be gradual. Some general controls over construction must be retained to assure completion of essential projects and to prevent the drain of resources from war production and essential construction to less essential projects.

"The construction order L-41 formerly prohibited construction without specific WPB authorization, except for jobs falling within very small annual cost limits. Applications for permission to undertake new construction above these limits were in general denied except where projects were clearly required for the prosecution of the war or for war-supporting activities.

"Under the new version of Order L-41, (issued May 29, 1945), small industrial and commercial structures and certain other types of projects important to the civilian economy may be undertaken without specific WPB authorization. Major construction projects for which WPB authorization is required must still be justified as essential to war production, or to public health and safety and critical civilian needs. In addition, some reconversion projects that will contribute to employment when full-scale reconversion is possible will be authorized.

"The amended order provides for the resumption of the safest maximum volume of construction consistent with availability of construction materials, particularly lumber, and of manpower, both for construction and for industries producing materials and components for construction."

Chief provisions of the amended order are:

Construction work on certain types of buildings is permitted without WPB authorization if the total cost of work on a unit in one year is not greater than amounts specified. Categories are somewhat different from those formerly established and cost ceilings have been raised to approximately five times the former amounts. Types of buildings and cost limits follow:

(1) One-family house, including a farmhouse, $1,000; two-family house, $2,000; three-family house, $3,000; four-family house, $4,000; and five-family house, $5,000. These limits apply to repair and maintenance work as well as to alterations and new construction. Cost limit for a house up to and including a five-family house was formerly $200.

(2) Farm construction, exclusive of farmhouses, $1,000. Formerly the $1,000 limit included the farmhouses, for which not more than $200 could be spent.

(3) An irrigation or drainage system serving more than one farm, $1,000. This exemption is the same as in the former order.

(4) A hotel, apartment building or other residence for six or more families, $5,000. The cost limit was formerly $1,000.

(5) An office, bank, store, laundry,

"I don't think it's necessary to carry along the Bullwinkle Library of Practical Electricity every day, Miss Potts!"

DAVIS TRANSFORMERS

¾" CONDUIT IN LEFT AND OUT OF RIGHT SIDE.

BRACKET FOR WALL MOUNTING

"DAVIS" DRY TYPE
3 KVA, 3 PHASE, 60 CYCLE
208Y/120-115

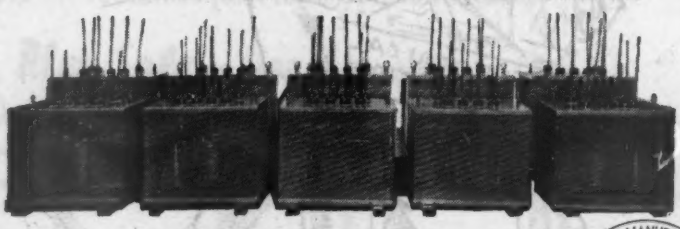
Dry Type Transformers for Power and Lighting

- Fire Hazards Eliminated
- Installation Costs Low
- Light Weight Easily Handled
- Vaults not Required
- May be Located Adjacent to the Load Center, Permitting Short Cable Runs.

"DAVIS" DRY TYPE, 25 KVA 550-110/220 FOR WALL MOUNTING, WITH CONDUIT NIPPLE CONNECTIONS IN COVER

DAVIS DRY TYPE TRANSFORMERS

READY FOR SHIPMENT FOR ALL PURPOSES



DAVIS TRANSFORMER COMPANY

DAVIS TRANSFORMER CO.

Phone 177 CONCORD, N. H.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION NEMA MEMBER

and

STOCKWELL TRANSFORMER CORP.

CONCORD, N. H.—Phone 177 AKRON, OHIO—Phone Jefferson 4179

Manufacturers of Oil Cooled, Dry Type, Power and Distribution Transformers
Also All Types of Specialty Transformers Regardless of Size

garage, restaurant, theatre, warehouse or other retail or wholesale service establishment, including a frozen-food locker plant, $5,000. This category formerly had a cost limit of $200. Warehouses were in separate category with a $1,000 limit, and $200 was the limit for a frozen-food locker plant.

The amount of maintenance and repair work that may be done on buildings in categories (4) and (5) is limited. Formerly there was no such limitation.

(6) A church, hospital, school, college, United Service Organizations club, public playground for children, a publicly-owned building or group of buildings used for public purposes, an orphanage or other building used exclusively for charitable purposes, a military exchange on an Army or Navy reservation, a canal, storm sewer, dam, levee, a jetty or retaining wall needed for shore protection, $10,000. Three former categories with $1,000 limits have been combined in this group, and some new types of construction have been added.

(7) A factory, plant or other industrial plant including logging and lumber camps, a bridge, over or under-pass, tunnel, dock, pier, commercial airport, bus terminal, truck terminal operated by a common or contract carrier, a railroad or street railway building or group of buildings, a research laboratory or a pilot plant, $25,000. Formerly, the cost limit for a bridge, over or under-pass, tunnel, dock, pier, airport, bus or truck terminal, railroad or street railway buildings, was $1,000. The limit for a factory or plant was $5,000, except that if the product manufactured was in Schedule A of the former order, the limit was $200.

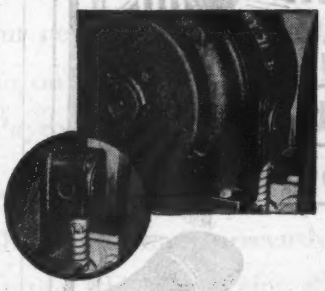
Schedule A does not appear in the amended order. Formerly, construction jobs in plants manufacturing products listed in Schedule A could be undertaken without WPB authorization only within an annual cost limit of $200.

(8) Any other kind of unit, $1,000. Cost limit for this category was formerly $200.

Twenty-three special kinds of construction may be undertaken without WPB permission regardless of annual cost

Victor H. Tousley, IAEI secretary, talks to W. L. Gaffney, Tacoma, Northwestern Section secretary at Utah Chapter IAEI meeting.

Designed for close quarters



An innovation of the Fairbanks-Morse general-purpose motor is the recessed conduit box for neat installations where space is at a premium.

The leads can be brought in between the feet of the motor through a tapped hole in the motor frame, and the conduit box cover mounted flush with the frame. Neat installations are simple because of this feature. A conventional conduit box is provided, and may be used if desired.

The recessed conduit box is another of many features which make this the motor best suited to your use. To appreciate it fully, see a demonstration. Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Ill.

Every Good Feature You Could Ask!

Copperspun Rotor—The *only* rotor centrifugally cast in one piece—and of *copper*.

Protected Frame—Excludes dripping liquids and falling particles.

Cross-flow Ventilation—Another exclusive feature. Air moves in both directions, providing uniform cooling—no hot spots.

Ball Bearings—Sealed in and protected.

Adaptability—Frame gives protection in any mounting position because the vented bearing brackets can be turned to four positions 90° apart. Reversible frame permits locating conduit box on either side.

Balanced Characteristics—A 40° C. motor with high efficiency and power factor, and excellent starting and accelerating torques.

BUY WAR BONDS TO BACK THE FRONT

Fairbanks-Morse

A name worth remembering

Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps • Scales
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

Pioneers in
LIGHTING EQUIPMENT
Since 1880

Faries

Yes, We've been at WAR..

Since Pearl Harbor, our only customers have been the U. S. Army and Navy . . . and our Allies. Faries war products have been wide in range . . . more than 200 completely assembled items and component parts. To meet the exacting requirements of the Military, new machines have been employed, new production techniques mastered.

. . . but now that the

Light Flashes Green

we'll soon be ready to GO with over 60 of the fastest-selling numbers from the big Faries prewar line.

When the restrictions are fully relaxed and material is available, we're ready to start immediate production on 60 "best sellers", in accordance with a carefully-worked-out reconversion plan. These top-quality lamps and fixtures will be available to distributors and dealers for the period 'till V-J day.

New Flyer Catalog

Write for New Flyer Catalog

. . . just off the press, illustrating these 60-odd "best selling" numbers.

limits. These exemptions are, in general, the same as formerly appeared in the order, its Schedule B and interpretations and directions.

The most important liberalization is grading, ditch-digging or similar earth-moving operations, if no lumber or other building materials except drainage pipe are permanently installed. Formerly, earth-moving operations were permitted only when no building materials except clay tile and non-reinforced concrete pipe were used, and when the operations could be completed without the use of other materials. Such work may now be undertaken in preparation of future construction. The exemption will permit initiation of work on highways, airports and other types of construction, WPB officials pointed out. They emphasized, however, that the new exemption does not mean that WPB will necessarily approve construction in the future or grant priorities assistance, even if the applicant has done a large amount of preliminary work under the exemption.

Other important changes in exemptions are:

The exemption for maintenance and repair work has been changed to limit the amount of work on (1) hotels, apartment buildings and other residences for six or more families, and (2) offices, banks, stores, and other retail or wholesale service establishments, that may be done without authorization. In any year, the amount spent on repairs on such structures may not exceed 20 cents for each square foot of gross floor area. In addition, the owner may use up part or all of his $5,000 exemption for repairs, but the allowance for new construction must be reduced accordingly. Repair and maintenance work costing above the permitted amount requires WPB authorization.

The exemption for the installation of equipment (formerly Direction 2) has been broadened to permit installation or erection of equipment outside buildings. However, installation of service equipment is permitted only when the equipment was obtained on a specific application, such as WPB-541.

Limitations on minor capital additions have been relaxed to permit industries manufacturing products formerly listed on Schedule A and all organizations covered by CMP Regulation 5A to take advantage of the exemption on minor capital additions. Formerly these industries and organizations were excluded from the exemption.

Some of the former directions and interpretations have been superseded by provisions of the order and others have been revoked. The following are still in effect:

Direction 3: Blanket Permission for Miscellaneous Construction (amended May 29, 1945, with no substantive changes.)

Direction 5: Construction Projects for Starting Civilian Production (formerly titled "Construction Projects for Reconversion");

Interpretation 2: Motion Picture Sets;

Interpretation 9: Installation of Equipment and Fixtures;

The Pace of Victory Permits Only A Congratulatory Handshake!

American Industry well merits a decoration for its brilliant record in the Mighty 7th! But, as our newly decorated Pacific heroes quickly return to combat, so industrial leaders aren't resting on their laurels. *Back into Bond action*—they are now busy consolidating recent Payroll Savings Plan gains!

First, **many executives are now patriotically working to retain the substantial number of new names recently enrolled during the 7th War Loan. By selective resolicitation, they are urging all new subscribers to maintain Bond buying allotments.**

Second, **many are also employing selective resolicitation to urge every worker who increased his or her subscription in the 7th to continue on this wise, saving-more-for-the-future basis.**

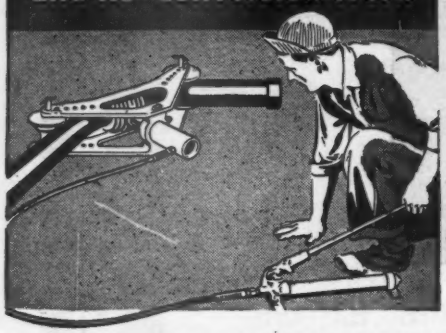
Help to curb inflationary pressures and harvest peacetime prosperity by holding the number of Payroll Savings Plan subscribers—and amounts of individual subscriptions—to the mark set in the Mighty 7th!

The Treasury Department acknowledges with appreciation the publication of this message by

Electrical Contracting

★ *This is an official U. S. Treasury advertisement prepared under the auspices of Treasury Department and War Advertising Council* ★

JUST THE "TICKET"
for Your Immediate Needs
and Re-Conversion Work



Low-Cost BLACKHAWK
Pipe Bender
has EVERYTHING!

- COMPACT
- PORTABLE
- ONE-MAN OPERATION
- ON-THE-JOB ACTION
- BENDS PIPE AND RIGID CONDUIT FROM 1" TO 4"

You bet! — and Blackhawk Hydraulic Pipe Benders operate at any angle — avoid kinking, save need for heating or cutting and threading and use of elbows and couplings. Compact 10 or 20-ton ram and big range of attachments also handle many other bend, straighten, press, push, pull, spread and clamp jobs.

Right — Easy to operate even on ladder. *Below* — Rolls right to the job.

MAIL COUPON TODAY

BLACKHAWK MFG. COMPANY
Dept. P 2075, Milwaukee, Wis.

Send full information about your Pipe Benders.

Name.....

Company.....

Address.....

Interpretation 11: Installation of Machinery and Equipment under subparagraph (e) (20) of L-41 (formerly Direction 2);

Interpretations 9 and 11 were amended May 29, 1945, with only slight modifications.

Order L-41-d, which provided exemptions for maintenance and repair of asbestos siding and roofing, was revoked. The increased allowances for residential construction and repairs now in L-41 make this order unnecessary, WPB said.

DIRECTION 5 TO L-41 AMENDED

Slightly more leeway in approving applications for construction projects needed for starting or resuming civilian production or services was announced today by the War Production Board. Broadening of the criteria to be met for WPB authorization of such construction is designed to further reconversion to the extent that such construction can be undertaken without interference with war production or with more essential war-supporting activities, WPB said.

Direction 5 to the construction order L-41, as amended on June 11, sets up three categories of construction projects with criteria that must be satisfied within each category before authorization is granted. Applications are still filed on Form WPB-617 and, in general, AA-3 preference ratings are assigned to approved projects.

This amendment also provides for authorization without priorities assistance of projects that do not completely meet the stated criteria, or projects for which materials and equipment are on hand or are available without priorities. However, such projects will not be approved unless they can be completed without supplementary requests for priority assistance on bottleneck items, WPB emphasized.

Direction 5 formerly covered bottleneck construction jobs required for starting or resuming civilian production. The three categories established in the amended direction are:

(1) Additions to or alterations of existing facilities to make civilian products, representing slight modifications of the type formerly covered by Direction 5.

(2) Facilities for production of bottleneck materials or components used in other industries.

(3) Facilities for needed civilian production or services, representing a slight expansion of types formerly approved by WPB, and now specifically itemized in Direction 5.

Order L-41 was also amended today to make minor clarifying changes.

WPB authorization of construction jobs covered by Direction 5 must satisfy the following criteria:

For additions to or alteration of existing facilities to make civilian products:

(1) Postponement of construction would result in unduly delaying the beginning or resuming of production, and

(2) The construction is a relatively minor expansion of the applicants' facilities that are to be used in the production for which the expansion is requested, and

(3) The construction is no more than is needed for production at the minimum economic rate, and

(4) The construction is not for replacement or improvements of existing facilities that are adequate though less efficient.

For facilities for production of bottleneck materials or components:

(1) Postponement of construction would result in unduly delaying production of the materials or components when they are needed for other manufacturing operations, and

(2) Lack of the materials or compo-

NISA officers elected at the meeting of the new Board of Directors recently held in Chicago are: (L to R) executive-secretary—Fred B. Wipperman, St. Louis, Mo.; treasurer—Selden F. High, Cincinnati, Ohio; president—Wm. H. Braunlich, Pittsburgh, Pa.; vice-president—R. B. Turner, Windsor, Ontario, Canada; secretary—H. E. Grant, Nashville, Tenn.

Carry your part of the load

Separate and tie in bundles: 1. Wastebasket scraps. 2. Corrugated boxes, brown paper and bags. 3. Magazines and books. 4. Newspapers.

send every scrap of WASTE PAPER TO WAR

V-E DAY did not ease the waste paper shortage. Paper is *still* urgently required for the millions of tons of supplies being used against Japan as well as for essential home front needs. Double and even triple wrapping is needed to guard against the hazards of the long sea trip and such conditions as jungle dampness, dry rot, and insects.

That's why waste paper is still a No. 1 war material shortage. All old paper not actually useful in your business is needed *now*. Dig out those old files and records!

A good way to get waste paper collected is to *appoint a Salvage Chief* in your office. Let that person take charge of getting all your old paper bundled and turned in. Then . . . if it isn't collected regularly, he should call your local Salvage Committee.

And remember, the only way to help avoid further drastic cuts in civilian paper allotments is for *everyone* to save waste paper.

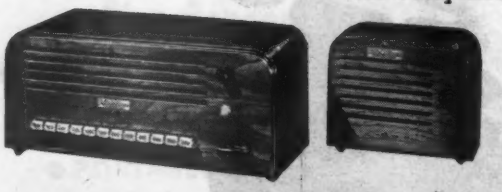
This advertisement prepared by the War Advertising Council in cooperation with the War Production Board and the Office of War Information. Space contributed to the Waste Paper Program by this publication.

ASK YOURSELF

"Why Should I Be Satisfied With Less Than *Everything*"?

Ask yourself this one, too . . . "Why should I lose out on profitable business because I cannot meet every inter-communication requirement"?

No reason why you *should* be satisfied . . . why you *should* miss fire on sales. *Because* Talk-A-Phone, the World's Most Advanced and Complete line of Inter-communication "Has Everything" specialized engineering skill *can* provide in convenience, flexibility, efficiency and carefree operation. *And* there's a unit for every need . . . no matter how simple or complex.



Easy to install. Extensively advertised. Good deliveries now. See your jobber for complete details. Don't be satisfied with *less* than "Everything".

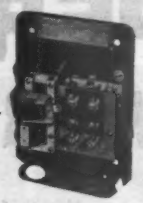
Talk-A-Phone Mfg. Co.

1512 So. Pulaski Rd. Chicago 23, Ill.

★MERCOID CONTROLS★

FOR HEATING, AIR CONDITIONING, REFRIGERATION, AND VARIOUS INDUSTRIAL APPLICATIONS

TEMPERATURE CONTROLS



MERCOID RELAYS

MERCOID HAS WHAT EXPERIENCED ENGINEERS WANT IN AN AUTOMATIC CONTROL

1. Designed for positive safety—*the prime purpose of a control.*
2. Built for years of dependable performance—*a very desirable feature.*
3. Simplified for ease of installation—*appreciated by the trade.*
4. Convenient facilities for making understandable adjustments—*no time lost in calculating or guesswork.*
5. The only 100% Mercury Switch Equipped Control Line—*which means that all "makes" "and breaks" in the electrical circuit are hermetically sealed, therefore immune to dust, dirt, corrosion, open arcing, pitting, or sticking of contacts—all common causes of contact trouble. Mercoid Switches provide an electrical contact that will give millions of perfect operations.*

The above facts merit your consideration. For detailed information see Mercoid catalog No. 600.

EXPLOSION PROOF PRESSURE CONTROL

MERCURY SWITCHES

LIQUID LEVEL CONTROLS

THE MERCOID CORPORATION • 4201 BELMONT AVENUE • CHICAGO, ILLINOIS

nents would seriously retard other manufacturing operations, and

(3) A shortage of the materials or components for other manufacturing operations is threatened when other materials and components needed for the operations will be available.

For facilities for needed civilian production or services:

(1) Postponement of construction would result in unduly delaying the production or service, and

(2) The production of the product has been permitted throughout the war for general civilian use, and

(3) (i) The product is an essential item serving basic needs of the population, or

(ii) The service is an essential requirement of the community or will contribute substantially to the national economy, and

(4) There is now a shortage of the product or service for civilian use and a continued shortage is expected.

DEALERS JOIN CHICAGO ELECTRIC ASSOCIATION

With the recent affiliation of the local radio and electric appliance dealers, the Electric Association of Chicago rounded out its full representation of the entire electrical industry in the Windy City—manufacturers, contractors, maintenance engineers, wholesalers, utilities and dealers.

At an initial "get acquainted" session on May 16 more than 160 local radio and appliance dealers learned the preliminary

Precision tolerances of one-millionth of an inch are required in the manufacture of ball bearings for military aircraft. Here, Fred Burkholder, president of the Ahlberg Bearing Company, Chicago, explains the use of an electric gauge for checking bearing races to Colonel R. L. Finkenstaedt, new commanding officer of the Air Technical Service Command, Midcentral District, Chicago.

Maurice Dussenberry, Line Material Co., A. E. Fleming, senior electrical engineer, Headquarters Ninth Service Command, and Kimball Vance, electrical contractor, Salt Lake City at IAEI meeting.

plans to unite all branches of the local electrical industry in a coordinated sales effort preparatory to the postwar return of appliances. W. T. Reace, president of the Electric Association and vice-president of Commonwealth Edison Company revealed that promotional programs to foster sales following the expected "easy selling" period are already under consideration.

Edison plans are being developed around the assumption that dealers can do a selling job with promotional assistance, E. M. Ball, dealer cooperation department, Commonwealth Edison Company, told the group. The utility will renew its financing plans as soon as Regulation W permits and the company will again pay installation costs on electric ranges and water heaters in residences of three stories or less, he revealed. Upon dealer request, the Edison company will also provide architectural aid in kitchen planning, provide display and sales training and appliance demonstrations in the home; also cooperative advertising and as much help as the dealers may need. Although company stores will sell all appliances, field selling will be confined to items that need promotion, such as ranges, water heaters and room coolers.

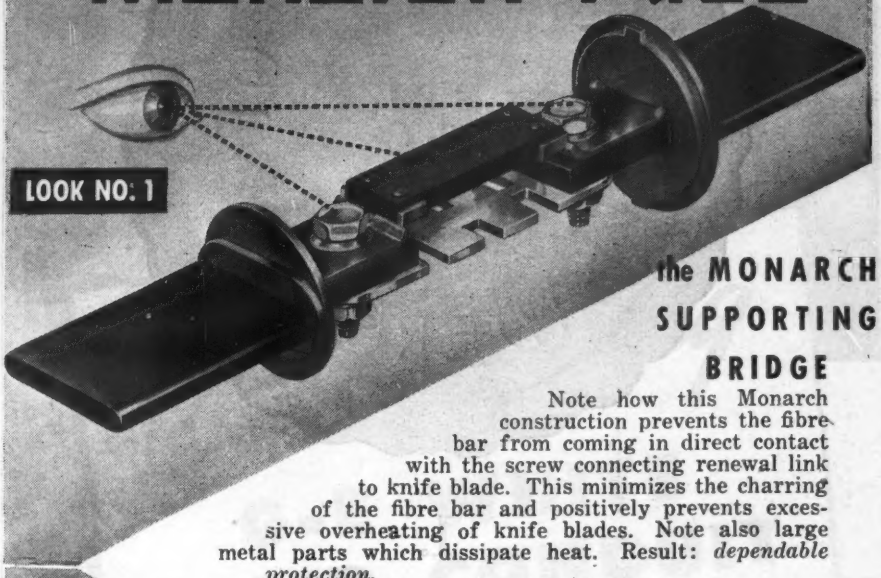
Similar plans for other communities in the Chicago area were outlined by G. C. Heisterman, manager, dealer sales department, Public Service Co. of Northern Illinois.

Major A. A. Gray, secretary-manager of the Electric Association told the group that an advertising program will be developed for dealers and that mechanical aids to selling such as displays and training in selling, store management and operation will be provided.

A. J. McGivern, director of the Chicago Electrical Wholesalers Association revealed that wholesaler plans call for maintenance of a strict dealer policy with distribution solely through them.

Detailed results of 35 years of operation of a plan similar to that proposed

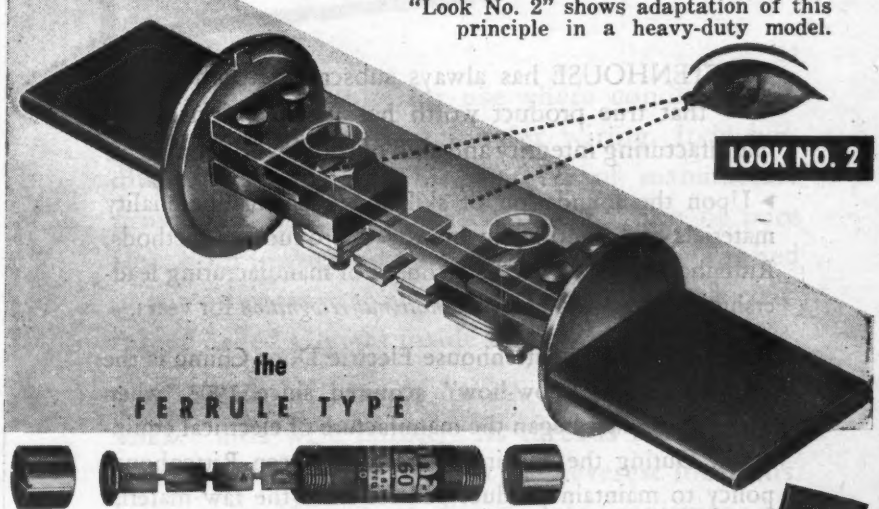
Take a TWO-WAY LOOK AT THE Monarch Fuse



the MONARCH SUPPORTING BRIDGE

Note how this Monarch construction prevents the fibre bar from coming in direct contact with the screw connecting renewal link to knife blade. This minimizes the charring of the fibre bar and positively prevents excessive overheating of knife blades. Note also large metal parts which dissipate heat. Result: *dependable protection.*

"Look No. 1" illustrates this construction in a lighter-duty Monarch knife-blade fuse and "Look No. 2" shows adaptation of this principle in a heavy-duty model.



the FERRULE TYPE

Specify Monarch Fuses *for improved* FUSErvice

MONARCH FUSE CO., LTD.
118 E. FIRST ST., JAMESTOWN, N. Y.

1.

Standards of Manufacture

RITTENHOUSE has always subscribed to the belief that true product worth has its inception in the manufacturing integrity and skill of those who produce it.

▸ Upon the foundation of skilled craftsmanship, quality materials and continually improved production methods, Rittenhouse has attained a standard of manufacturing leadership that has won and held *national recognition* for years.

▸ Built into every Rittenhouse Electric Door Chime is the ingenuity and "know-how" acquired since 1903, when Rittenhouse first began the manufacture of electrical equipment. During the ensuing years it has been Rittenhouse policy to maintain product control from the raw material right through to the finished appliance. This time-tested policy continues today. Virtually the entire chime is made in the Rittenhouse plant, by Rittenhouse craftsmen; each stage of the manufacturing process under expert supervision.

▸ These and many other noteworthy factors of leadership will be reflected in the Rittenhouse Chimes of Tomorrow—chimes that will meet every challenge of peacetime performance

Rittenhouse

Tomorrow's Better Door Chimes

THE A. E. RITTENHOUSE COMPANY, INC., HONEOYE FALLS, N. Y.

for the Chicago area were presented by J. E. North, president of the Electrical League of Cleveland, sponsors of the Cleveland plan.

E. K. Ploner, vice-president, Chicago Flexible Shaft Company, and J. S. Strecker, General Electric Company, rounded out the guest speaker list at the meeting.

A proposed steering committee of the new group will work with officers of the Electric Association in perfecting the advertising and dealer assistance program. Plans for an intensive membership drive (present membership is 177) were also formulated at the meeting.

BUILDING MANAGERS URGE ADDITIONAL RELAXATION IN L-41

Easing of certain limitations governing office building maintenance, alteration and repair work under Construction Order L-41 was recommended by industry members at a recent meeting of the Office and Loft Building Industry Advisory Committee, the Office of Civilian Requirements of the War Production Board has reported.

Members said that although the May 29 amendment to L-41 permits higher expenditures for new construction work, operating difficulties still exist in relation to maintenance and repair work. Adoption of the following recommendations, they said, would alleviate these difficulties:

1. Maintenance and repair work limitations now based on maximum calendar year expenditures of 20 cents for each square foot of gross floor areas should be increased. Statistics will be furnished to prove the limitation figures are too low to permit efficient operation of old buildings and equipment. Annual cost limits of $5,000 for new construction work exempt from WPB authorization should be increased to $25,000 for the same reason.

2. Greater latitude in permitting renovations should be given building operators to whom returning war veteran-physicians apply for their former quarters. Returning veteran physicans often find their old offices occupied by other practitioners, and extensive plumbing and appliance changes are necessary to accommodate them.

APPLICATIONS AUTHORIZED FOR CONSTRUCTION AND EQUIPMENT

From April 1 through June 8, 1945, preference ratings were authorized on 553 applications for bottleneck items of equipment and construction for preliminary reconversion, the War Production Board has reported. Representing value of $139,815,000, they were issued under Priorities Regulation 24 and Direction 5 to Conservation Order L-41.

The greatest number of applications in

any group continues to come from the automotive industry, which has had 161 applications authorized through June 8.

Geographically, Michigan leads in the number of authorizations, with a total of 166 for all items.

A summary of the applications under Direction 5 to L-41 follows:

Industry	Number of applications Dir 5 L-41	Value ($000) Dir 5 L-41*
Washington	72	85,182
Field	96	3,763
Food and kindred products	1	63
Textile mill products	6	445
Furniture & finish lumb prod	8	383
Chemicals and allied products	3	180
Stone, clay & glass products	3	105
Iron and steel and products	30	8,655
Rolling mills and foundries	13	7,255
Wireworks, etc.	2	171
Hardware, etc.	1	84
Enameled-iron sanitary ware	2	98
Stoves, ranges, etc.	5	202
Automobile stampings	1	98
Enamelling, japanning, etc	2	107
Steel springs	3	630
Other	1	10
Nonferrous metals and products	6	286
Aluminum products	1	34
Electroplating, plating, etc	2	151
Electric lighting fixtures	1	35
Nonferrous metal foundries	1	46
Other	1	20
Machinery (except electrical)	25	2,765
Domestic laundry equipment	3	283
Domestic mech refrigerators	7	1,964
Refrigeration equip comm	4	249
Other	11	269
Electrical machinery	3	316
Electrical appliances	2	308
Automotive elec equipment	1	8
Transportation equip (ex auto)	1	188
Automobiles and equipment	71	75,267
Other industries	11	292

* Includes building, equipment and other construction costs, excluding land.

DIRECTION 6 TO PR-1 AMENDED

Maintenance, repair and operating supplies obtained under Direction 25 (MRO for conversion to new products) to Controlled Materials Plan Regulation 5 or obtained without priorities assistance are included in items exempted from the inventory limitations of Priorities Regulation 1, the War Production Board announced. Action was taken to amending Direction 6 to PR-1.

The amended direction further states that inventory restrictions of PR-1 do not prohibit delivery or acceptance of such MRO items. It previously stated that inventory restrictions of PR-1 do not apply to items for which a person gets a rating under PR-24, to jigs, dies and fixtures obtained pursuant to Direction 25 to CMP Regulation 5, or to capital equipment and jigs, dies and fixtures obtained without priorities assistance.

Nothing in the amended Direction 6 permits receipts of MRO in excess of applicable MRO quotas.

Protect Wiring WITH G-E WHITE RIGID CONDUIT

Choose G-E White for use where conditions require the utmost protection for wiring. It is hot-dipped galvanized. This method of manufacture provides a heavier, more durable coating of pure zinc, both inside and outside, than could be applied in any other way. In addition, G-E White has a coating of baked Glyptal inside and out.

G-E White is easy to install. Its smooth interior surface aids wire pulling. Its threads are accurate. Moreover, it can be used in the severest locations. It is resistant to heat, flame, cold, moisture, gas alkalies and mechanical injuries. (Another G-E conduit, G-E Black, is also available. This conduit is enamel coated and is recommended for interior use where conduit is exposed to chemical corrosion.)

FOR FURTHER INFORMATION see the nearest G-E Merchandise Distributor or write to Section C751-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

BUY WAR BONDS AND HOLD THEM

GENERAL ELECTRIC

PARTS FOR FANS MOTORS CONTROLS

PROMPT SHIPMENT FROM LARGE STOCKS

AUTHORIZED PARTS DISTRIBUTORS

Brown-Brockmeyer
Century
Cutler-Hammer
Delco
Diehl
Duro
Emerson
General Electric
Hamilton-Beach
Holtzer-Cabot
Howell
Hunter
Ilg
Leland
Marathon
Master
Peerless
Robbins & Myers
Star
Thor
Wagner
Westinghouse

READING ELECTRIC COMPANY, INC.

Parts Distributors for the Manufacturer

200 William St. ***Barclay 7-6616*** **New York 8, N. Y.**

ELECTRICITY

For Any Job—Anywhere

Reliable, economical electric service for electrical contracting projects anywhere, anytime, with an Onan Electric Generating Plant. From the 65 basic models, the right plant for any job or application, large or small, can be selected.

Driven by Onan built, 4-cycle gasoline engines, these power plants are of single-unit, compact design and sturdy construction. Suitable for all mobile, stationary or emergency service.

Model shown is from W2C series, 2 and 3-KW, 60-cycle, 115 volt; powered by water-cooled, 2-cylinder engine.

ELECTRIC PLANTS
Onan
POWER AND LIGHT FOR EVERY NEED

Models range from 350 to 35,000 watts. A. C. types from 115 to 660 volts; 50, 60, 180 cycles, single or three-phase; 400, 500, and 800 cycle, single phase; also special frequencies. D. C. types range from 6 to 4000 volts. Dual voltage types, available. Write for engineering assistance or detailed literature.

Over 250,000 In Service

D. W. ONAN & SONS 2104 ROYALSTON AVE. MINNEAPOLIS 5, MINN.

CMP REG 9A AMENDED

An electrical appliance repairman may supply new connecting cord that he obtained under the provisions of Controlled Materials Plan Regulation No. 9A if the building or electrical codes for the area in which he is located require it, even though the old cord might be patched or repaired to serve for the remainder of 1945, the War Production Board has announced.

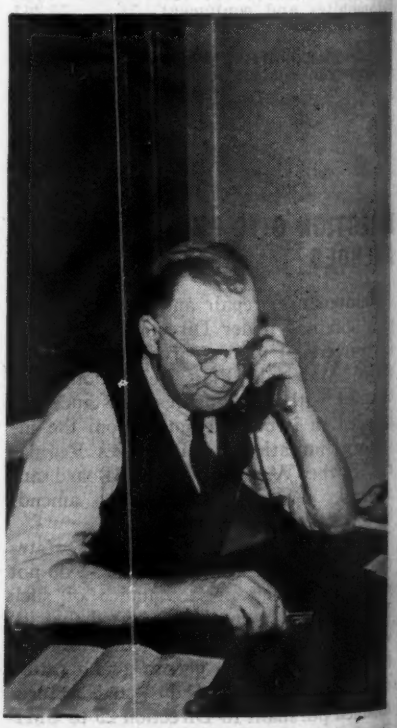
This change is made by an amendment to CMP Regulation No. 9A (April 17, 1945), which formerly prohibited such installations if the existing cord could be patched or cut off to give reasonably good service for the remainder of this year, WPB officials said.

The type of cord involved is that which is generally supplied for vacuum cleaners, washers, refrigerators, irons, radios, lamps and other electrical appliances, WPB explained.

NECA ANNUAL MEETING CANCELLED

The forty-fourth Annual Meeting of the National Electrical Contractors Association will not be held this year. It had been scheduled for September 9 to 15 at the Grand Hotel, Mackinac Island, Michigan.

The War Committee on Conventions has denied a permit for the meeting. The



Over 30 years of motor repair experience in Columbus, Ohio, is the proud record of E. A. Williams, president, American Electric Company. His firm is so busy that, between phone calls, he rolls up his sleeves to help out in the shop.

transportation crisis has been growing more acute since V-E Day and ODT has tightened restrictions against any meetings which would call for travel of more than 50 persons beyond local commuting distances. The burden on the railroads in the next six months in moving several million men toward the Pacific blocks any relaxation in time for the meeting.

The NECA Board of Governors will be called to meet in Chicago early in October.

MOST FHA PAYMENTS BELOW $40 MONTHLY

More than half of the 1,300,000 home owners purchasing single-family houses under the FHA program are paying for them in monthly installments of less than $40.

In the pre-war period from 1935 through 1941, the gross monthly payments of more than 50 percent of those buying homes with FHA insured mortgages were below $40.

Under the war housing program in operation since 1942 the average monthly payments for single-family homes have been even less. For example, in 1944 owners of nearly 100,000 such homes, privately-financed with FHA mortgage insurance for war-worker families, are paying for them in monthly installments averaging $36.55.

These figures were announced by Commissioner Abner H. Ferguson of the Federal Housing Administration, who pointed out that the monthly payments include interest, mortgage insurance, hazard insurance, property taxes and retirement of principal under the terms of the mortgage, which may run for as long as 25 years.

Analysis of property valuations of new single-family homes built with FHA insurance during the 1935-41 period and involving some 670,000 dwellings shows that 45 percent of the houses cost less than $5,000.

Of the 1,300,000 single-family homes which have been financed with FHA mortgage insurance, about 75 percent were of new construction and the remainder were existing structures.

These figures are significant in view of the present efforts in many communities to include the financing of electrical appliances and household equipment in original FHA mortgages.

CMPR NO. 6 AMENDED

Restrictions on the use of steel, copper and electrical materials in construction work specifically authorized by the War Production Board subject to Schedule A to Controlled Materials Plan Regulation 6 (Construction Limitations) have been eliminated by an amendment to that schedule, WPB reported. Restrictions on the use of lumber, tin, lead and zinc have

Dependable sources of good light—good *Fluorescent* and Incandescent Lamps—mean better production and more of it at lower cost. Your own experience during this emergency period has proved that.

When your lamps carry the CHAMPION Diamond mark you can depend on these four "diamond points" of value:

1. Champion Lamp Quality — guaranteed to equal or exceed Federal Specifications and maintained by the engineering, production and testing resources of one of the largest and most responsible manufacturers in the lamp industry, specializing in fine lamp manufacture since 1900.

2. Champion Service—trained lighting experts readily available to give you competent and unbiased counsel on correct lighting application for every purpose.

3. Champion Economy—Champion Lamps for industrial application are designed and distributed to assure minimum lighting cost, and lower lamp costs.

4. Champion Supply Efficiency—carefully developed through a carefully selected industrial distributor in your locality, equipped to meet essential service needs promptly and capably.

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

Here's a New READY REFERENCE BOOK on Commutators

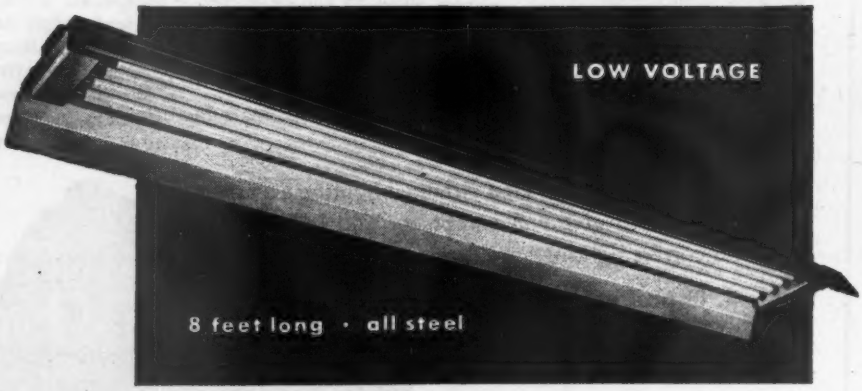
Do you know we manufacture from 15 basic types over 3000 variations of Commutators? This data book contains all the specifications necessary for you to order your repairs easily. Some of these may even be in our stock.

We want you to have a copy of this book—write today. Which will it be—Toledo or Homer?

Three sources to choose from—all under capable and experienced management . . . Our representatives are located in key cities throughout the nation.

TOLEDO STANDARD COMMUTATOR CO. – Toledo 6, Ohio
HOMER COMMUTATOR CORP. – Cleveland 3, Ohio
HILLSDALE COMMUTATOR CO. – Hillsdale, Michigan
THE NATION'S LARGEST EXCLUSIVE MANUFACTURERS OF QUALITY COMMUTATORS

*COLOVOLT COLD CATHODE INDUSTRIAL FIXTURES



Here is the new Colovolt industrial fixture, one of a complete line of industrial and commercial "packaged" units. Equipped with the standard 93" Colovolt 10,000 hour lamp, Colovolt fixtures may be used singly or in continuous line lighting in multiples of 8 feet. Instantaneous starting, no flickering, guaranteed for 1 year except for failure due to breakage are extra advantages of the Colovolt Cold Cathode low voltage fluorescent lamp. The long life expectancy of Colovolt lamps may be realized even when constantly turned on and off, and *pre-scheduled re-lamping, with no loss of production or time, is now possible with Colovolt installations.*

*Trade mark registered U. S. Pat. Off.

Contact your electrical wholesaler or jobber, or write us for full details and prices.

GENERAL LUMINESCENT CORPORATION
672 S. FEDERAL STREET CHICAGO 5, ILLINOIS

been retained in the amended regulation with only slight changes.

Builders who have previously received Form-GA-1456 authorizations may now take advantage of these changes.

Provisions of Appendix II of this schedule on the use of ratings for equipment have been modified. With the exception of oil-fired equipment and natural gas-fired equipment, any equipment that can be obtained without a rating may now be installed under the project authorization. However, in general the rating may not be used to get equipment that is not listed and approved. These changes in Appendix II do not apply to authorizations issued before the date of issuance of today's amendment.

UTILITIES ORDER U-1 AMENDED

Revocation of virtually all controls on installation of facilities by electric, gas, water and communications utilities was announced by Edward Falck, director of the War Production Board's Office of War Utilities.

The new policy will permit utilities to make any addition to plant on an unrated basis, except construction of buildings

Ernest Parsons, owner of the Parsons Electric Co., Juneau, Alaska, and member of the Alaska Association of General Contractors, reports the outlook for the electrical contracting business in Juneau (7000 population) is very good. The government has allotted 30 new homes that can be privately built and is itself building a 30-apartment housing development. A five-story office building that burned down is being re-built, also a new laundry building and an addition to the cold-storage plant. Parsons, himself, will soon move into a new store where he will conduct a dealer business, and aims to make it one of the best of its kind in Alaska.

with a materials cost in excess of $25,000, without obtaining prior authorization from Washington. Building projects costing less than $25,000 worth of materials also will be permitted on an unrated basis without authorization.

Utilities Order U-1, the basic wartime regulation covering electric, gas and water utilities, has been amended as of June 2, 1945, to incorporate this "open-ending" of construction.

Removal of construction controls on utilities, Mr. Falck estimated, will result in utility expenditures for plant expansion next year approximately twice the total volume of expenditures during 1943 and 1944. The OWU Director estimated that utility expenditures under the "open-ending" policy will be at least $1,630,000,000 in 1946, compared to $815,000,000 in 1943 and $787,000,000 in 1944. Because of the long time required in manufacture of most utility facilities, additional expenditures during the remainder of 1945 as a result of "open-ending" probably will not exceed $40,000,000, Mr. Falck added.

MORE LUMBER FOR FARMS

An additional 23,000,000 board feet of lumber has been allotted to the War Food Administration for distribution to farmers for emergency maintenance and repair of farm dwellings in the third quarter of 1945, the War Production Board has announced.

Farmers make application for the lumber to the County Agricultural Conservation Committees, and approved applications are rated AA-3 by delegation of authority from WPB to WFA. Emergency cases for which applications will be approved are limited to repair of damage caused by fire, flood or similar disaster, or repair of dwellings that would be uninhabitable or a definite hazard to the health of the occupants if not repaired immediately, WPB said.

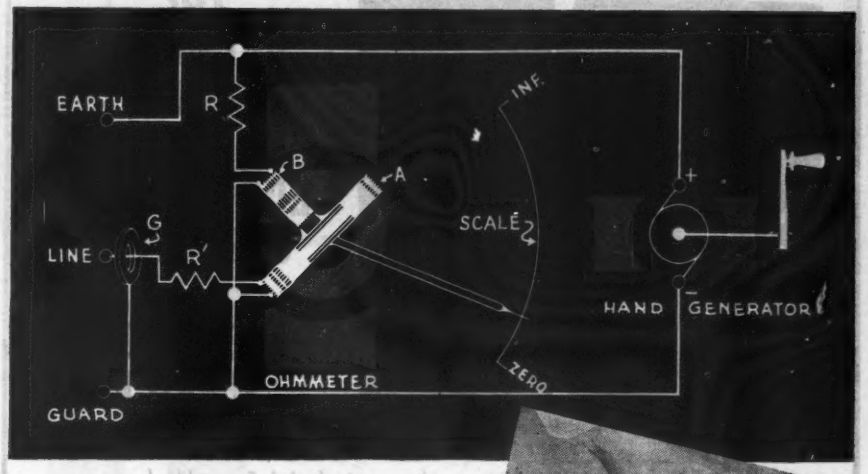
The lumber allotted to WFA is transferred from the amount originally allotted to WPB's Office of Civilian Requirements in the third quarter of 1945 for maintenance, repair and operating supplies for farm dwellings, WPB said. A similar transfer of 22,000,000 board feet for emergency repair of farm dwellings was made in the second quarter.

MINNESOTA REA PLANS 57,700 NEW CUSTOMERS

The postwar planning committee of Minnesota REA Cooperatives has projected a program for bringing electric service to 57,700 new customers, according to a report recently released by the Minnesota Electric Cooperative Association of St. Paul. The dollar amount of the business this program will produce is given as $62,946,500. The report of the committee states in part:

Here's why—

"MEGGER"* Insulation Testers are always dependable—



In what we term a cross-coil true ohmmeter, two coils are mounted in fixed relation to each other on the same pivot-and-jewel moving system in the field of a permanent magnet. "Current" flows in coil A and "potential" in coil B, and they are connected so that their respective torques oppose each other. Since there are no control springs, the opposing coils give a true ratio of E/I, and ohms (or megohms) are indicated by a pointer over a scale. The readings are independent of the voltage of the hand-driven d-c generator, because any change in the voltage affects both coils in the same proportion.

The "Megger" instrument is simplicity itself. The circuit diagram shows *all* elements—hand-cranked generator, fixed resistance coils and ohmmeter with pointer and scale. Nothing more is needed and nothing could be simpler. In making resistance tests, you merely connect leads from the instrument to the apparatus or circuit under test, turn the crank for a few seconds, and read the insulation resistance directly on the scale.

Power generation and distribution practice has dictated certain standards of quality and performance that every piece of electrical equipment is expected to meet. "Megger" insulation testing instruments have been and will continue to be built in conformity with these high standards.

For complete descriptions and applications of all types of "Megger" Insulation Testers write for Catalog 1685-EC.

**Trade Mark U. S. Pat. Off.*

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA 7, PA.

BADGER

Synchronous Automatic TIME SWITCHES

for ACCURATE TIMING

•

ECONOMICAL OPERATION

•

YEARS OF GOOD SERVICE

•

● *Prompt delivery on orders rated AA-5 or Higher.*

Type	Poles	Switch Capacity	Case
M1 (Synchronous)	1	50 A. at 125 V.	16 Ga. Steel
M2 "	2	50 A. at 125/250	16 Ga. Steel
RM "	1	50 A. at 125 V.	Cast Iron
RM5 "	2	50 A. at 125/250 V.	Cast Iron

RELIANCE AUTOMATIC LIGHTING CO. RACINE WISCONSIN

Bakelite Boxes and Covers

Nos. 3050 & 4050

Nos. 3051 & 4051

Nos. 3053 & 4053

are the answer on every non-metallic wiring job.

CLAMPS, supplied with all boxes, to properly secure every wire.

Approved by Underwriters Laboratory.

See April issue Electrical Contracting page 152, under "Questions on the Code" where Mr. F. N. M. Squires explains, according to National Electrical Code, where non-metallic boxes MUST BE USED.

Literature and samples gladly submitted, for your consideration.

Nos. 3056 & 4056

Nos. 3057 & 4057

No. 4055

No. 6050

No. 5051

No. 5053

No. 5055

No. 7050

UNION INSULATING CO., INC.

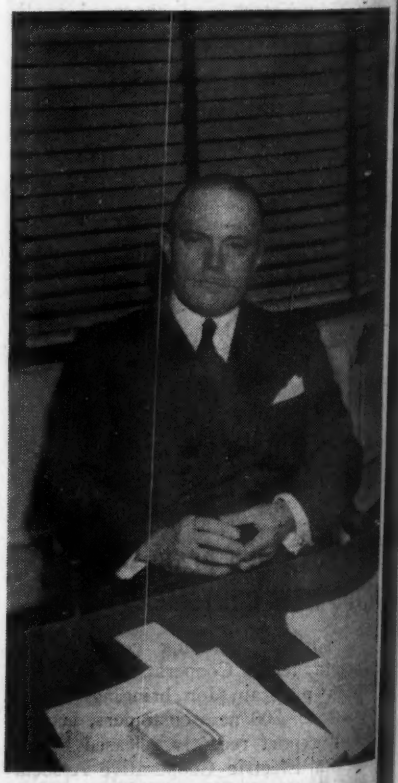
P.O. Box 351 • Parkersburg, W. Va.

"The procedure followed by REA cooperatives up to now has been the building of main lines which naturally have been located in thickly settled territory, most of these lines being completed. The work of the future consists of a network of branch lines. The program up to the present has resulted in the electrification of approximately 40% leaving approximately 60% of the farms in Minnesota still eligible for and vociferously requesting electric service. To carry out this program the REA cooperatives, 51 in number, have made plans for a three year period which will require $31,500,000 and bring electricity to 57,700 unserved rural customers within three years after materials and manpower become available for large-scale rural power line construction.

"It is estimated that within three years after electric service is made available, farm consumers receiving service for the first time will spend an average of $145 each for wiring and $400 each for electrical appliances, making a grand total of $62,946,500, as shown herewith:

57,700 rural consumers—wiring at $145 each	$ 8,366,500
57,700 rural consumers—appliances at $400 each	23,080,000
Expansion program (line construction)	31,500,000
Total	$62,946,000

"The expenditure of this amount of money will provide twenty-two million man hours of labor. This should make it possible for a large number of veterans to find employment immediately upon their return to civilian life."



Setting the pace for electrical activities in Rochester, N. Y. is Ed J. Kramer, Executive Secretary, Rochester Electrical League.

CONTRACTORS MAY FILE PROPOSED PRICING METHODS WITH OPA

Building contractors who have newly entered the industry or have shifted operations to an unfamiliar type of construction may file with the Office of Price Administration proposed ceiling prices or price determining methods to be used in computing their individual ceiling prices on lump-sum or cost-plus contract work, the price agency has announced.

Proposed pricing methods may be filed for any job performed on a contract basis with which the contractor has not had sufficient experience to base prices on those he has charged in the past for a comparable sort of work, or for any other reason.

Authorization to apply to OPA for approval of a pricing method became effective June 18, 1945.

Applications should be filed with the Office of Price Administration, Building Materials Price Branch, Washington 25, D. C.

This procedure of applying to OPA for approval of a price is being provided as the result of recommendations made by the OPA Board of Review following protest proceedings brought by the Associated General Contractors of America, Inc.

Boards of review are panels appointed from OPA officers and employees by the Price Administrator when a protest is filed against provisions of a price or rent regulation.

The boards hear oral arguments, consider objections, and make recommendations.

OKLAHOMA PASSES BILL TO LICENSE ELECTRICAL CONTRACTORS

A Bill has been passed in Oklahoma providing for the licensing and registration of all electrical contractors, journeymen and apprentices doing business in Oklahoma, by the State Board. House Bill 407 cleared the State Senate on April 26, 1945 and was signed by Governor Kerr on May 7. It becomes effective on August 1, 1945.

CONSTRUCTION OF DWELLINGS IN MAY SHOWS INCREASE

Construction of nearly 32,000 dwellings was authorized under the H-2 housing program during the month of May, bringing the total number of such units programmed since last November to almost 73,000 in 366 separate localities. Administrator John B. Blandford, Jr., of the National Housing Agency, announced.

The 32,000 units of H-2 authorized in May compares with slightly more than 18,000 programmed in the preceding month of April.

At the same time it was announced that

SMALL DIAMETER, THERMO-PLASTIC INSULATED

FLAMENOL* Building Wire

For Complete Wiring Systems

TYPE T for General Purpose Wiring

TYPE TW for Wiring in Wet Locations

Use this high quality building wire for new wiring, reconversion wiring or maintenance wiring. It is available in two types in sizes 14 to 2,000,000 CM: Type T for general purpose wiring and Type TW for wiring in wet locations. The small diameter of this wire and its smooth, glossy finish make it easy to pull. Stripping may be done quickly. There is no over-all braid on the wire. Moreover, its small diameter enables more copper to be placed in conduits. The insulation of both Types SN and SNW Flamenol Building Wire has long life, is high in dielectric and mechanical strength and is resistant to oils, acids and alkalies. Type SNW insulation also has a low moisture absorption rate.

HEAVY DUTY FLAMENOL CORD

FLAMENOL CORD

Here is a good looking, tough, flexible cord you'll like to use. It is available in three types: heavy-duty for severe conditions, medium duty for less severe conditions and rip cord for use on lamps, fans and other small devices.

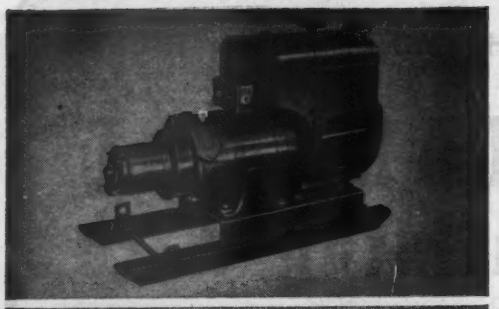
FOR FURTHER INFORMATION

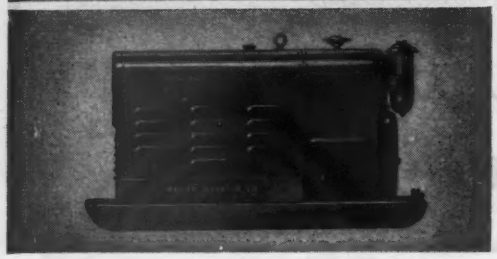
see the nearest G-E Merchandise Distributor or write for Flamenol Building Wire and Cord folders. Address Section W751-8, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

*Reg. U.S. Pat. Off.

BUY WAR BONDS AND HOLD THEM

GENERAL ELECTRIC





MASTER GAS-ELECTRIC GENERATING PLANTS

COMPACT PORTABLE

SAVE TIME AND SPEED WORK WHEREVER POWER OR LIGHTING IS REQUIRED

Eleven basic sizes from 500 watts to 17,000 watts and 30 different types to meet all AC or DC power or lighting requirements. Housed or open models . . . available with wheelbarrow, buggy or trailer mounting. For operating a single tool or motor, or floodlight . . . or gangs of tools, groups of motors, or lighting entire areas. Easy to put in operation . . . economical to operate and maintain. Compact, portable, self-contained.

For complete details write for Bulletin 594.

MASTER VIBRATOR COMPANY DAYTON 1, OHIO

Distributors throughout United States, Canada and other countries

Products include: Portable Gas-Electric Generator Plants, 500 watts to 17,000 watts, Voltage Regulators and Portable Mountings Optional • Master Flood and Shovel Lights • Concrete Vibrators (Gas or Electric) High Speed Tools and Concrete Surfacing Attachments • Big 3—Generators and Tool Equipment • Concrete Vibratory Finishing Screeds • Concrete Troweling Machines (Gas or Electric) • Electric Hammer and Spade, Hammer Tools • Pavement Breaker and Tie Tamper • Back-Fill Tamper and Tie Tamper • Grinding Machines and Tools • Electric Hoist (Export Only).

priority applications for construction of 35,541 new dwellings under the H-3 program had been approved through May 4 —6,652 of them in March and 7,901 in April.

Under the H-3 program veterans discharged or released from active military service are granted priorities to build a home for their own occupancy. In addition the H-3 program is designed to take care of cases of individual hardship arising from considerations of health or safety and to replace housing destroyed or damaged by flood, fire or other hazard.

Local quotas still must be cleared with Production Urgency Committees in Class I and II labor areas to determine that sufficient manpower is available to carry out the construction without interference with war production. The War Production Board recently removed the necessity of clearing local quotas in Class III and IV and unclassified labor areas.

Priorities under the H-1, H-2 and H-3 programs are issued by the State and District offices of the Federal Housing Administration, a unit of the National Housing Agency.

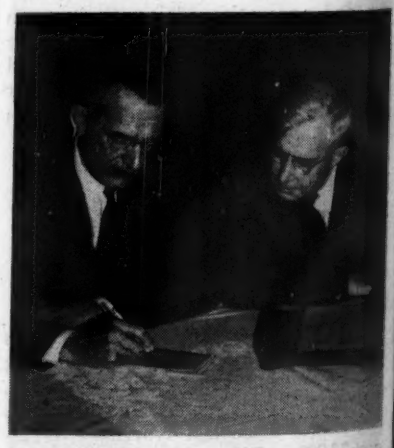
SWPC BROADENS LOAN PROGRAM

Hundreds of small manufacturers, making thousands of essential civilian products, will now be able to obtain loans from the Smaller War Plants Corporation under new policies adopted by the corporation, Maury Maverick, Chairman and General Manager, announced recently.

Small plants also will be able to obtain loans more easily and quickly under the two-fold liberalized program, Mr. Maverick said.

By unanimous vote of its board of directors, SWPC has provided:

(1) Regional loan agents may make loans for war or "essential civilian pro-



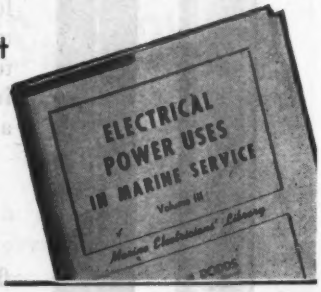
Comparing rewind time schedules are prominent motor service shop operators John E. Launder, Kansas City, Mo. (left), and A. L. "Andy" Brown, Worcester, Mass., at recent NISA Board of Directors meeting in Chicago. Discussion centered around recent NISA Bulletin No. 233 covering rewind time schedules.

Your guide in shipboard electrical work

- When an electric motor breaks down
- When equipment isn't operating right
- When a part needs adjusting

Consult this handy reference **to parts, use, regulation, control of MOTORS, CRANES, GEARS, LAMPS, and all other shipboard electrical apparatus.**

Provides direct guidance for the most efficient operation and maintenance of all electrical equipment, except radio, completely in line with modern practice. Put it to use to insure greatest efficiency from your electrical power installations, and as a dependable guide for your operators in control and maintenance.



Just Published

ELECTRICAL POWER USES IN MARINE SERVICE

Vol. III Marine Electrician's Library

By **J. M. DODDS**

Field Engineer, Pacific District Engineering Division, General Electric Company; Instructor, Engineering Science, Management War Training, University of California

434 Pages, 5¼x8¼, 185 illus., $4.00

Contains description of:

A-C and D-C motors

Crane and hoist motors

Gears

Complex control circuits

Ordinary incandescent lamps

Vapor discharge, glow and fluorescent lamps

• Over 25 tables provide useful tabulated information concerning motor speeds, effect of variation of voltage on various motors, candle powers, etc.

Clear, simple, complete explanations of:

- **Fundamentals of the ordinary incandescent lamp**
- **Direct current electric ship propulsion and control**
- **Control of the deck winch, capstan, anchor hoist**
- **Maintenance of electrical equipment —control, windings, brushes, commutators, bearings**
- **Deduction and correction of electrical trouble aboard ship**

SEE IT 10 DAYS ON TRIAL

McGRAW-HILL BOOK COMPANY, Inc.
330 West 42nd St., New York 18, N. Y.
Send me Dodds' Electrical Power Uses in Marine Service for 10 days' examination on approval. In 10 days I will send $4.00 plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....

Address .....

City and State .....

Position .....

Company ..... EC. 7-45

(Books sent on approval in United States only)

duction" up to $50,000 without awaiting Washington approval, and may make loans up to $100,000 where banks participate for 20 percent.

(2) All products on the Relative Essentiality List of the Office of Civilian Requirements of the War Production Board, will be considered as "essential civilian production," and manufacturers of these products will be eligible for SWPC loans. Products not under the jurisdiction of the Office of Civilian Requirements but on WPB's National Production Urgency List also will be considered essential, and SWPC loans may be made for their production.

These lists include thousands of items, from wearing apparel and baby carriages to mop wringers and X-ray equipment. The value of all items on the proposed lists represented well over half of the value of all manufactured goods in 1939.

Mr. Maverick pointed out that Public Law 603, which created SWPC, empowered the agency to make loans "to enable small business concerns to finance the acquisition of equipment, facilities, machinery, supplies or materials, or to supply such concerns with capital to be used in the manufacture of articles, equipment, supplies or materials for war or essential civilian purposes."

With small plants almost exclusively engaged in war production, it is estimated that less than three percent of SWPC's $350,000,000 in loans have been for essential civilian production, Mr. Maverick said.

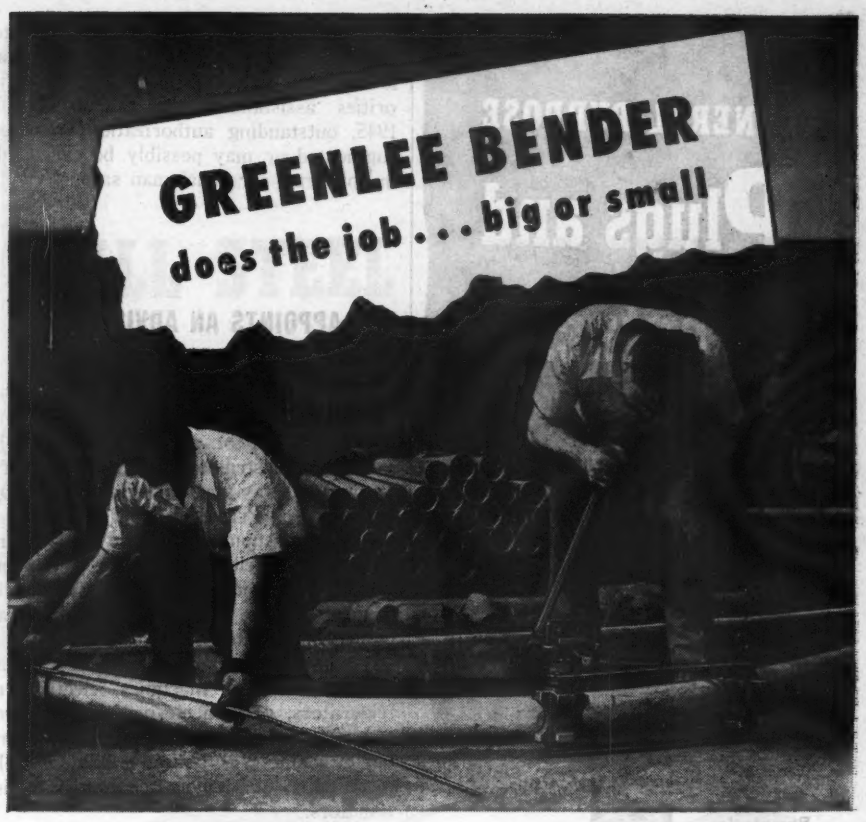
"Loans for war production will continue to have preference," Mr. Maverick said. "However, as civilian production is increased, SWPC's broadened loan program will assist small plants not needed in war production to switch to essential civilian production."

NO IMMEDIATE INCREASE IN CONTROLLED MATERIALS FOR CIVILIAN USE

Allotments of controlled materials to non-military claimant agencies for the third quarter of 1945 carry with them no advance allotment authority greater than that already outstanding for the fourth quarter, Lincoln Gordon, program vice chairman and chairman of the Requirements Committee of the War Production Board, said.

Mr. Gordon explained this to mean that while the controlled materials authorizations already issued for deliveries in the fourth and subsequent quarters are not being withdrawn, WPB will not issue any additional "tickets" to non-military claimant agencies for deliveries after September 30, 1945, except in unusual circumstances.

The reason for this action is that WPB hopes to put as much fourth quarter production as possible on an unrated basis and is therefore keeping fourth quarter commitments to a minimum, pending final decision as to how much production must continue to be programmed after September 30, Mr. Gordon said.



"We selected GREENLEE Hydraulic Benders because they seemed the most practical type for construction purposes—light weight, portable, simply operated", reports R. Walters, Purchasing Agent, Ferguson Electric Construction Co., Buffalo, N. Y.

And GREENLEE equipment has certainly delivered as expected . . . efficiently expediting that company's jobs such as the one shown above, where 600 feet of 4-inch conduit were bent, mostly in 10-foot lengths.

You, too, will find that whatever the bending job, large or small . . . pipe up to 4½-inch, rigid and *thin-wall* conduit, tubing, bus-bars . . . there's a GREENLEE to do it better, faster, easier.

One-man operated for smooth, accurate bends in a few minutes without kinking or damage to conduit.

Easily pays for itself first few times used through valuable savings of your time, manpower, materials.

Write for free Catalog 33E for facts on all GREENLEE tools for electrical workers. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1747 Columbia Avenue, Rockford, Illinois, U.S.A.

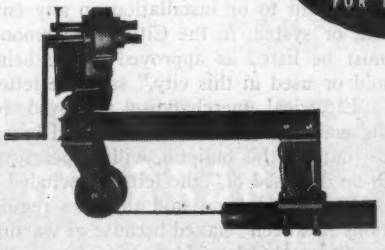
Special Notice: GREENLEE Electricians' Bits now available in 10, 11, 12-sixteenths sizes.

Get Ready with Greenlee!

REGISTERED TOOLS

GREENLEE

FOR THE CRAFTSMAN



GREENLEE CABLE PULLER

Simple, compact unit exerts 7500 lb. maximum pull, has two speeds through direct and back gears. Fastens direct to conduit—allows pulling in line with conduit, prevents hanger loosening. Flexible elbow attachment for pulling from concealed conduit.

OTHER GREENLEE TIME-SAVING TOOLS FOR ELECTRICAL WORK

Hand Benders • Joist Borers • Radio Chassis Punches • Knockout Tools • Pipe Pushers

GENERAL PURPOSE

Plugs and receptacles

General purpose plugs and receptacles with round prong contacts are ideal for portable equipment wiring—available in 2, 3, 4, and 5 pole types, 30 amp. 125 volts DC, 250 volts AC.

Fuseless plugs and receptacles are also available in 60, 100 and 200 amp. ratings up to 600 volts, for disconnect service.

Consult your Pylet catalog for complete listings.

THE PYLE-NATIONAL COMPANY
1344 N. Kostner Avenue, Chicago 51, Illinois

Depending upon decision of WPB as to the quantity of non-military production to be given controlled materials and priorities assistance after September 30, 1945, outstanding authorizations may be augmented or may possibly be cancelled, the program vice chairman said.

OPA APPOINTS AN ADVISORY COMMITTEE OF ELECTRICAL DISTRIBUTORS

Appointment of an Electrical Supply Wholesale Distributor Industry Advisory Committee, was announced last month by the Office of Price Administration.

Electrical supply wholesale distributors are sellers of electrical supply equipment used in construction such as wire, cable, switches, lights, and supply items such as motors and transformers.

They do not handle appliance items, such as washing machines, electric refrigerators, vacuum cleaners and toasters unless they own combination concerns doing business as both wholesale supply distributors and wholesale appliance distributors.

There are approximately 1,600 electrical supply wholesale distributors in the country. Of this number, five percent are large concerns, 15 percent medium size, and 80 percent small firms.

CITY OF RICHMOND CONVERTS TO PEACETIME ELECTRICAL INSPECTIONS

In Richmond, Va., dealers in electrical supplies have been notified by the Department of Public Utilities that it will resume strict enforcement of the city electrical ordinance August 1. Letters to that effect have been mailed to all listed dealers in electrical supplies and appliances, it was stated. It reads.

"Due to the fact that the Federal government is releasing large quantities of materials which can and are being used in the manufacture of fluorescent and other types of electrical fixtures, devices, appliances, etc., this is to advise that on and after August 1, 1945, this bureau will strictly enforce the city electrical ordinance which requires that all electrical devices and all appliances designed for attachment to or installation on any current or system in the City of Richmond, must be listed as approved before being sold or used in this city," said the letter.

"Electrical merchandise approved for the war emergency and purchased before the date of this bulletin, will be permitted to be disposed of," the letter concluded.

Director Hobson said that the regulations had been relaxed because of wartime conditions, but he said that insofar as electrical inspection is concerned, his department is reconverting to a peacetime basis.

How to save time by doing more reading

That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

And we most emphatically mean *both* the editorial and the advertising pages.

Just one new idea gleaned from these pages . . . a method for doing something better or faster or easier or at lower cost, may alone save you far more than a year's reading-hours invested in this and other worthwhile business papers.

Many people have found this a fact . . . not only once, but time and time again. That's significant . . . with time so precious today.

Good advertising speeds information from those who have it . . . to those who need it.

★

McGraw-Hill Publishing Company, Inc.

330 West 42nd Street
New York 18, N. Y.

Electrical Inspector, B. A. "Mac" McDonald is taking an active part in discussion of code changes now under consideration. His inspection work covers the Rochester, N. Y. area, where he has been located for several years.

WPB REVOKES 19 LIMITATION ORDERS AND SCHEDULES

Revocation of 19 War Production Board limitation orders and schedules were announced by the agency from May 26 to June 1, including L-123 General Industrial Equipment.

The revocations affect a large number of items for civilian and industrial use. Generally speaking, they are items that require only small amounts of steel in their manufacture.

WPB officials reiterated that, in announcing these revocations, they had considered carefully the question of employment in towns where production cut-backs are anticipated, with consequent release of labor, and where it is known that the items can be produced.

NEMA STANDARDS FOR ELECTRIC WATER HEATERS

The National Electrical Manufacturers Association has compiled in one publication, No. 45-104, all existing NEMA Standards for storage type electric water heaters. The standards included cover: voltage ratings, pressure ratings for tanks, wattage ratings of elements for single and twin-unit heaters; temperature settings, differentials, and adjustment ranges for thermostats; standard wire color coding for connections.

This new standard, together with NEMA Publication No. 103 gives manufacturers and purchasers of electric storage type water heaters convenient access

ALL STEEL INDUSTRIAL FLUORESCENT FIXTURES

For

ESSENTIAL PLANT LIGHTING

OAMCO All-Steel Heavy Duty Industrials incorporate many desirable features for installations in plants where maximum lighting efficiency and minimum service delays are essential. Reflectors that can be removed for cleaning without disturbing wiring or using tools and starter replacements without lamp removal are but two of the features that speed up servicing.

Reflectors are furnished with either synthetic or porcelain enamel finish and have a reflection factor of more than 80%. Exterior finish is gray.

Enclosed Ballast type are furnished in double 40, triple 40 and double 100 watt sizes and the Exposed ballast type in double 40 only.

Write or wire today for our 1945 catalogs, Fluorescent #106 and Incandescent #104-A.

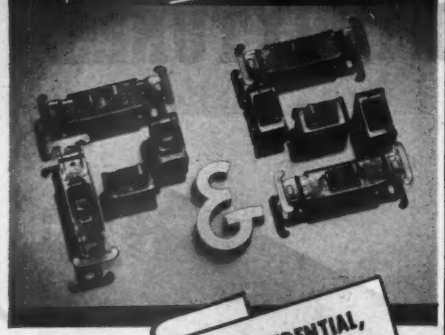
RIGHT LIGHT SINCE 1902

OVERBAGH & AYRES MFG. CO.

MEMBER OF THE R L M STANDARDS INSTITUTE

411 SOUTH CLINTON STREET • CHICAGO

TOPS IN Switches



FOR RESIDENTIAL, COMMERCIAL, INDUSTRIAL USE

The P&S 1815-D Line of Switches and P&S-Despard 1311 Line of Combination Switches—while designed to permit compact installations—are built to carry their full rated capacity—and carry Underwriters' T-rating.

If you have an application where space is limited and a good 10 Ampere switch is a necessity, here is the answer. Available in brown or ivory, in lock type or with luminous handles.

Send for your copy of the P&S Catalog today.

Sold Thru Electrical Wholesalers.

P&S

PASS & SEYMOUR, INC.
SYRACUSE 9, N. Y.

to standardization so far developed for this product.

These publications may be secured from the National Electrical Manufacturers Association, 155 East 44th Street, New York 17, N. Y. Prices are: Publication No. 45-104, 25 cents a copy, and No. 203, 50 cents.

NEW YORK UNION HELD LIABLE IN U. S. ANTI-TRUST SUIT

The Supreme Court decided last month that agreements made in the York City area by an electrical workers' union, manufacturers and contractors who install electrical equipment, violate the Sherman antitrust act.

The labor organization named is Local No. 3, of the International Brotherhood of Electrical Workers. The 2nd Federal Circuit Court ruled against the manufacturers, holding there was no restraint of trade or commerce.

The Supreme Court said the lower court's injunction should have been amended to enjoin only prohibited activities in which the union engaged in combination with others. It ordered the case remanded for modification.

INCREASE IN LUMBER EXPECTED IN THIRD QUARTER

Though lumber will remain in tight supply at least during the next four or five months, there will be more lumber

Solving tough kinks in electrical problems for contractors and plant engineers is one of the specialties of "Art" Popkin, G. E. Supply Corp., Apparatus and Supplies Sales Manager, Rochester, N. Y.

Test-O-Lite

TESTS ANY VOLTAGE... 100 to 550 Volts, A.C. or D.C. Safely, Swiftly, Surely

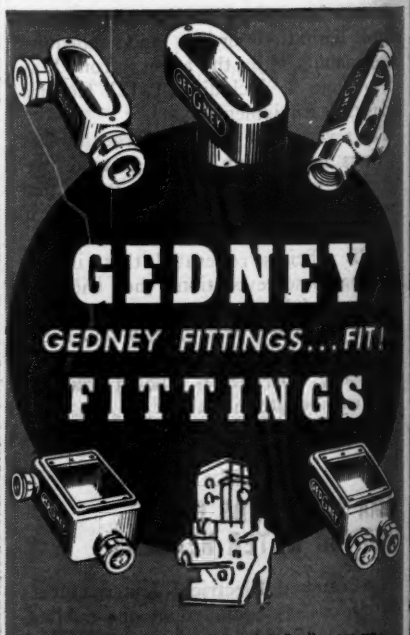
THE NEON GLOW LOCATES TROUBLE INSTANTLY

Indicates hot or grounded wires. Tells AC from DC. Far superior to ordinary clumsy test bulb. Indispensable in shop or home. Has PATENTED safety features. Vest pocket size. Life time guarantee. List $1.50. Purchase thru electrical dealers.

RTC-2 VINCENT RARE GAS RELAY

for harmonic or coded bells. Dual purpose device which economically improves both ringing and transmission on party lines. NO MOVING PARTS. Fully guaranteed. Can be installed in a minute.

L. S. BRACH Mfg. Corp.
55-63 Dickerson St. Newark, N. J.



GEDNEY

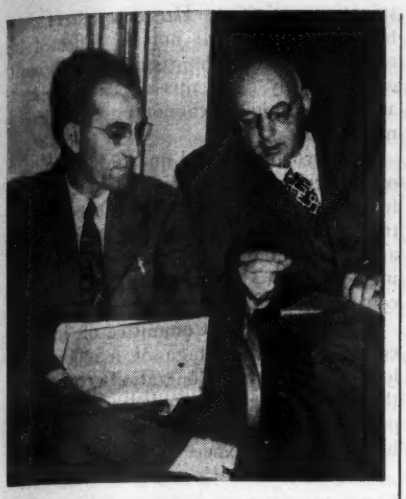
GEDNEY FITTINGS... FIT!

FITTINGS

GEDNEY Fittings and Conduit Bodies are rigidly inspected, cleanly finished and carry the approval of Underwriters Laboratories. They are carefully packed in metal-edge cartons convenient quantities, clearly labeled. Wholesale distribution only. Write for catalog.

GEDNEY ELECTRIC COMPANY

RKO BLDG RADIO CITY NEW YORK, N. Y.



New angles on shop equipment and possible deliveries are being discussed by F. T. Fosbee (left), Fort Worth, Texas, NISA Director from Region 13 and P. M. Potter, Woodman, Rayfield & Potter Co., Atlanta, Ga., at recent meeting of NISA Board of Directors in Chicago.

available for construction in the third quarter of 1945 than in the second quarter, according to J. Philip Boyd, director of the War Production Board's Lumber and Lumber Products Division.

Mr. Boyd is serving as chairman of the Interagency Committee on Lumber, recently organized by J. A. Krug, WPB Chairman, to study the factors at present retarding lumber production. Seven agencies are represented on the committee as various problems affecting lumber production require action in their several fields. The agencies are War Production Board, Army, Navy, National War Labor Board, Office of Price Administration, War Manpower Commission and the Selective Service System.

"WPB's two-fold problem of maintaining war production and at the same time providing for partial reconversion is particularly difficult in the case of lumber," Mr. Boyd said. "Decline in military demand for lumber will be felt at a later date than decline in military demand for many other war materials. Hence, lumber is faced with continued pressure from military needs and at the same time with pressure from expanding civilian needs. The Lumber Division's first responsibility is, of course, to see that all military needs involving lumber are met on time; its second responsibility is to provide as much lumber as possible for reconversion.

"Construction activity is to some extent the keystone of the partial reconversion made possible by V-E Day. Proposed third quarter allotments and reserves of lumber for civilian construction, maintenance and repair total 1,546,114,000 board feet, a 13 percent increase over those of the second quarter. This figure does not include maintenance and repair lumber for large industrial users (Class I consumers). When the full effects of recent cutbacks in military programs are felt by industrial users of lumber, it probably will be possible to make an additional 300 or 400,000,000 board feet available for further expansion of con-

The MORE YOU KNOW
. . . about the fuses you sell . . .
The MORE YOU'LL SELL!

THE NEW
ROYAL-NOARK
Non-Renewable FUSES
ARE 5 WAYS BETTER
. . . . A NEW
DESCRIPTIVE
CATALOG EXPLAINS WHY

Write for your copy
TODAY, and ask to have
a ROYAL man call!

ROYAL

WIRE • CORD SETS • CARTRIDGE and
PLUG FUSES • FUSTATS • TROUBLE
LIGHTS • CHRISTMAS LIGHTING SETS

ROYAL ELECTRIC CO., Inc., PAWTUCKET, R. I.

Get This Complete Data on Selling Guth Germ-Killing LIGHTS

NO PRIORITY NEEDED! QUICK SHIPMENTS!

GUTH Germ-Killing Lights provide you with one of the best profit-building opportunities in the whole industry! Every school, office, restaurant, and public building—as well as dairy, horse and poultry farms, food processors, meat markets, etc., are *all* potential buyers.

We have pioneered in designing and building *Germ-Killing Lights*, and our experienced engineering service is bound to help make selling easier for you.

Write today for detailed Bulletins on GUTH Germ-Killing Lights. They are packed with real, usable information to help you sell.

GUTH GERM-KILLING LIGHTS
Work More Effectively than a Surgeon's Mask

Guth

The Edwin F. Guth Co. • 2615 Washington Ave. • St. Louis 3, Mo.

Test Insulation the Modern Way with a MODEL B-5 MEGOHMER

NEW BATTERY-VIBRATOR TYPE

No more tiresome cranking of a hand-driven generator . . . Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.

VARIOUS NEW MODELS AND RANGES

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N. Y.

WRITE FOR BULLETIN No. 430-E

If You Are Having Difficulty Maintaining Your Mailing Lists . . .

Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled change in industrial personnel.

McGraw-Hill Mailing Lists cover most major industries. They are compiled from exclusive sources, and are based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff. All names are guaranteed accurate within 2%.

When planning your direct mail advertising and sales promotion, consider this unique and economical service in relation to your product. Details on request.

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street New York, 18, New York

struction activities. However, these cutbacks probably will not be reflected in changes in lumber requirements until early in July. For this reason the exact additional amount cannot now be determined."

The proposed third-quarter allotments of lumber for construction include lumber for a declining military-sponsored industrial construction program, and increased amounts of lumber for Government buildings, farm use, war housing and industrial construction, Mr. Boyd said.

The Interagency Committee on Lumber considers that shortage of manpower in logging and lumber operations constitutes the major deterrent to increased lumber production, with equipment shortages holding second place.

WMC RELAXES INTEROFFICE RECRUITMENT METHODS FOR VETERANS

So that more jobs will be made available to qualified veteran applicants reentering the labor market or disemployed as the result of war production cut-backs, a relaxation of interoffice recruitment methods—as they apply to veterans—is being put into effect by local offices of the United States Employment Service, the War Manpower Commission announced.

As a result of the new procedure, USES will accept and process, for interoffice recruitment, job orders from employers who specify they wish to employ veterans, even though such employers may be engaged in work of a less essential nature than was formerly demanded as a requirement by USES.

It was pointed out, however, that no order will be accepted for interoffice recruitment if qualified veterans or non-veterans are available in the local labor market.

The relaxation, as announced by WMC, will bring about the following changes in present interoffice recruitment standards:

1. The employer's order need not war-

V. D. Markham, Colorado Springs, who presided at the Denver meeting of Rocky Mountain Chapter, IAEI, talks to Leo Kelsey, Cheyenne, while in the background are Vic Moulton, secretary, Jim Mahan of Chicago and Vic Tousley, IAEI secretary

rant the assignment of a manpower priority rating.

2. Since the employer need not be engaged in war production, in order to hire veterans, and the veteran may take a non-war job if he prefers, the local USES will be free to clear such orders in any community where veterans may be available.

3. When a request for fewer than 10 workers is involved, the employer does not have to send a hiring representative or subscribe to advertising at recruitment points.

4. Although every effort will be made to urge employers to provide transportation, strict adherence to this standard will not be expected in the future.

It was pointed out by WMC that veteran applicants will first be told of higher priority jobs, and if they do not qualify for such jobs or refuse to accept the jobs offered, they will then be told of the lower or non-priority orders that have been placed by employers under the new interoffice recruitment program.

With respect to transportation, USES interviewers will inform applicants whether or not employers have agreed to provide transportation funds, so that applicants understand that in event no such agreement has been made, travel to the employer interviewing point is at their own expense.

According to WMC, arrangements are being made with employers so that action will be taken on applications within 24 hours after receipt by the employer.

This arrangement is made so that there will be a minimum time lapse and veterans will not lose other opportunities for employment if suitable jobs are not immediately available in their own communities. The procedure will also reduce needless travel by veterans in search of a job in other areas, WMC said.

A SIX-POINT PROGRAM RECOMMENDED FOR CONSTRUCTION ACTIVITY

Malcolm Pirnie, representing the American Society of Civil Engineers, has informed the Senate Small Business Committee that planning in advance for both public and private construction activity during the next few years has not been carried on in a manner which will encourage rapid expansion of building operations.

In order to remedy this situation, Mr. Pirnie recommended the immediate adoption of a six-point program by the Federal government, as follows:

1. Allow the cost of making private construction plans to be considered as current operating charges, exempt from federal income taxation.

2. Beginning immediately, gradually lift the limit of construction work coming under the War Production Board's L-41 Order. The limit now applying is $200. By raising this figure as rapidly as is found compatible with the military situation, the WPB will provide a powerful incentive for materials and equipment

KLEINS

WHEN HE COMES HOME

● He's finished his job for the Signal Corps—strung his last communication line under enemy fire—run his last power line to light an emergency first aid station. Now he's home again—back on the job of keeping America's peacetime communications moving—the motors of industry turning.

It will feel like old times buckling on his Klein belt—fastening his Klein climbers—a pair of sturdy Klein pliers in his hand. For these quality Klein tools and equipment that served him so well in the Army will serve him as faithfully on his peace-time job as they have other linemen and electricians "since 1857."

Anyone interested in linemen's equipment can obtain a copy of this folder on "Klein-Kord" on request.

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp., New York

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

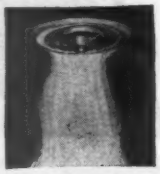
HOW *Blo-Fan* "*Spot*" VENTILATION WILL ADD TO YOUR *Profits*

YOUR home owner customers will want to be rid of unwanted air *at the source,* before it can penetrate into other rooms and leave its greasy film and disagreeable odors.

Blo-Fan "Spot" Ventilators—a patented combination of both fan and blower—do this most efficiently. They have *volume plus power!*

IN KITCHENS

A Blo-Fan, installed in the ceiling over the range, is twice as effective as a side-wall fan of similar size across the room.



IN GAMEROOMS

Gamerooms and dens will have increased popularity in postwar houses. A Blo-Fan will eliminate disagreeable odors of stale tobacco smoke and liquor as they form.

IN BATHROOMS

Every bathroom needs a Blo-Fan to remove steam and odors. Windows and mirrors are kept clear; excess humidity is avoided.

In every home job—be it moderate or high priced, modernization or new construction—there is a market for Blo-Fans. Not one but several! . . . Plan now to cash-in.

WRITE FOR FREE BOOKLET

PRYNE & CO., INC.
1245 E. 33rd ST. • LOS ANGELES 54
BRANCHES (TO BE REESTABLISHED AFTER THE WAR)
SAN FRANCISCO • SEATTLE • CHICAGO • NEW YORK

Officers elected at the Montana Chapter IAEI meeting. Terry W. Hatveldt city inspector, Billings, representing K. L. Chrysler, city engineer, 1st vice-chairman; George Blend, inspector, Army air base, Great Falls, new chairman; Ralph Grant, Havre, second vice chairman and James Clune, Chinook, secretary-treasurer

dealers to stock up, and will encourage the establishment of new dealerships to replace those closed during the war.

3. If possible, an immediate general tax reduction. If this is not possible then provide an incentive for risk capital to enter the construction field by exemption from surtax of income invested in construction.

4. Through the WPB, make tools and materials available to manufacture construction equipment for contractors.

5. Increase the 17½ million dollars recently appropriated to make available loans to state and local governments for public works planning which is to be administered by the Federal Works Agency.

6. Establish a statistical survey of construction plan preparation and actual construction volume, on a full-time basis. The Federal Works Agency is the logical place for the public works phase of this statistical survey. The suggestion has been made that the Bureau of Foreign and Domestic Commerce establish an over-all construction division to correlate all construction data.

Mr. Pirnie also expressed the belief that there are serious dangers in the too extensive use of public works for stabilization of the construction industry. He indicated that there are other means which can be used to stabilize the activities of the industry which are not as dangerous as the extensive use of public projects.

Controls offered by the witness are: (1) adjustment of incentive features in the Revenue laws of the country and changes in the interest rates on Federally insured construction loans. Public construction should be stabilized through the activities of the Federal Works Agency, according to Mr. Pirnie, but the two phases of construction operations should be coordinated.

The witness expressed the opinion that adoption of his six-point planning program would tend to place both public and private organizations in position to begin construction immediately when materials and manpower for such operations become available.

Federal Works Administrator Brigadier General Philip Fleming testified that the funds which have been at the disposal of the Agency have been altogether inadequate to carry on proper construction planning activities. The General indicated that he had recommended that a fund of $125,000,000 be established for his Agency to use in encouraging construction planning, but that before final appropriations were made, the total fund had been reduced to $17,500,000 which was altogether inadequate.

MOTOR SHOPS MAY USE 9A RATING FOR REPAIRS

Repairmen can now get ahead of unrated and AA5 orders for motor service. A new Directive 5 to CMP 9A says "despite the provisions of paragraph (f) of Priorities Regulation 3, repairmen using the ratings assigned by CMP Regulation 9A or Order P-126, may use the rating to get motors repaired, rewound, or rebuilt which are used in such products as household refrigerators, washers, oil burners, coal stokers, etc. or in commercial refrigeration systems." The new order became effective June 22.

Repair shop ideas are swapped at E.M.S.A. (Central District Chapter, NISA) meeting in Chicago, by (L to R) G. F. Glave, manager, Chicago Electric Co.; B. D. Greenberg, Kankakee Glass Co.; and Stanley Nudelman, Kankakee Electric Machine Co., Kankakee, Illinois.

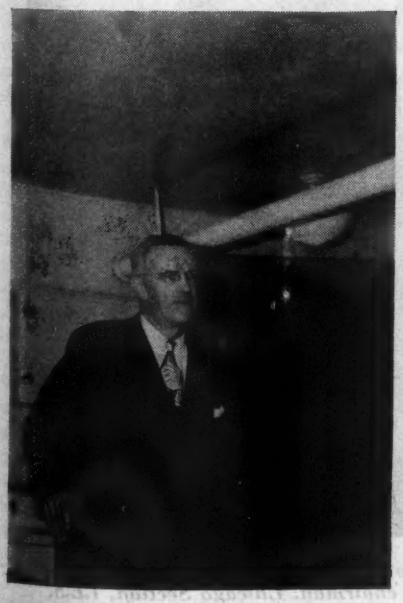
WPB ASSISTS SMALL BUSINESS

A square deal, and a fair deal, for small business is the War Production Board's aim as the country adjusts to the needs of a one-front war and resumes large-scale civilian production, J. A. Krug, WPB Chairman, told the Senate Small Business Committee last month.

The actions being taken by WPB in reconversion are designed, he said, to permit the orderly resumption of civilian production where it can be done without interference with war production or essential war supporting activities. War needs must continue to come first, Mr. Krug emphasized.

Mr. Krug said that WPB had carefully studied its control revocations and modifications before issuance to determine their effects on small businesses, which are confronted with unique and difficult problems during the transition period. WPB already has taken a number of important steps, he said, that are designed to safeguard the opportunity for small business to obtain materials and equipment needed for the production of civilian goods, and to prevent preemptive buying, buying ahead of need, or hoarding, which would be harmful not only to small business but to all of industry. The Chairman of WPB pointed out that the military cutbacks are releases of resources with which civilian production can be reestablished. During the early, difficult months of the transition, Mr. Krug said, smaller business concerns have been granted a preference over the larger plants desiring to reconvert in obtaining materials released from war programs.

The whole pattern of the WPB's program of modification of controls since V-E Day, Mr. Krug said, has been designed to permit maximum expansion of



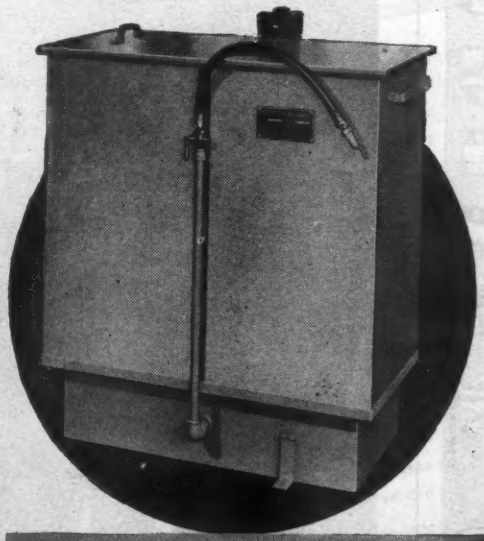
Ralph Grant, Havre, Mont. inspector, who presided at the Montana Chapter International Association of Electrical Inspectors meeting in the absence of Bruce Shavere.

in Parts Cleaning that means **Circo Chief Degreaser**

Speed combined with thoroughness in parts cleaning means greater production, less man hours, less effort, lower costs, higher profits, and that's exactly what you get with the new Circo Chief twin tank degreaser. Circo Chief's time schedule is minutes instead of the usual hours wasted in cleaning parts, a savings in time alone that will pay for the unit. This remarkable parts cleaning degreaser cleans dirty, greasy parts five different ways—hot vapor cleaning (automatic), spraying (automatic), drying (automatic), soaking and dipping, choice of which depends upon condition of parts.

Circo Chief automatically hot vapor cleans and dries greasy parts in three minutes, and that means every nook and corner of all parts are thoroughly cleaned.

Anyone can operate a Circo Chief degreaser as it heats automatically, starts and stops automatically, and automatically feeds itself solvent for vapor degreasing and drying. The new modern Circo Chief degreaser sets a new pace in fast, thorough parts cleaning, producing big savings in man hours and material, and a profitable "pay-off" on every parts cleaning job. Economical to buy and to use.



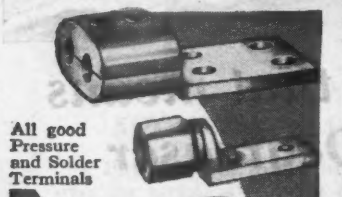
We would be glad to forward free literature on the Circo Chief degreaser, it's yours for the asking—write today.

CIRCO
PRODUCTS COMPANY
2835 CHESTER AVENUE
CLEVELAND 14, OHIO

You always find the
EXACTLY RIGHT
Terminal Lug—

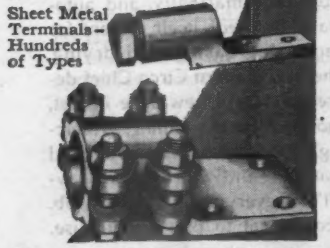
in the COMPLETE line

You'll see ALL good types of terminals in the Penn-Union Catalog. Shown above is the EZ; below are a few pictures giving an idea of the wide variety:



All good Pressure and Solder Terminals

Sheet Metal Terminals—Hundreds of Types



Also Tees, Taps, Straight Connectors, Grounding Clamps, etc. etc., thousands of items. And every one is Dependable, mechanically and electrically. Penn-Union fittings are the first choice of experienced users.

PENN-UNION
ELECTRIC CORPORATION
ERIE, PA.

PENN-UNION
Conductor Fittings

civilian production while preventing, through the retention of certain key controls, any wild scramble for limited supplies in which smaller business might be injured. Certain shortages are inevitable, some are temporary, others will be of longer duration, he said, but the preferential position given smaller business should safeguard its interests.

Chairman Krug summed up the steps WPB has taken to assist small business as follows:

1. Issuance of Priorities Regulation 27 to give blanket priorities assistance until December 31 to smaller manufacturers, which will give them preference in obtaining production materials over larger plants reconverting to general civilian production.

2. Small-order exemptions in allocation controls, which allow small businesses to place orders for many scarce materials below certain maximum quantities without applying to WPB for authorization.

3. Exemption of small plants from certain restrictions in the authorization of increased production. The most important of these is the exemption of plants employing 100 or fewer persons from the requirement of a manpower check in tight labor areas prior to authorization of expanded civilian production.

4. Limitation of manufacturers' stocks to a practicable minimum working inventory to prevent hoarding and encourage a fair and even distribution of materials in short supply.

5. Retention of two limitation orders controlling inventories of large wholesalers and retailers which do not apply to smaller distributors.

6. Provision for manufacturers producing over $50,000 per quarter to obtain priorities assistance on bottleneck items.

7. Maintenance of a careful watch over compliance with WPB orders, thus preventing a dislocation of supply for the honest majority of manufacturers by an unfair few. In addition, spot checks on big users of metal are now being started and will be intensified after July 1 (the date on which steel will be made available without CMP tickets).

8. An investigation, already started, of concerns involved in large contract cancellations or cutbacks to see that orders for materials ordered on such contracts are properly and promptly cancelled.

9. Maintenance of ceilings over the total volume of activities in nine major production industries and in construction, which will prevent these industries from draining all the supplies in the free market at the expense of other production.

Under Priorities Regulation 27, Mr. Krug told the committee, manufacturers who produce less than $50,000 worth of their own products per quarter receive a preference rating of AA-4 and assistance in obtaining needed controlled materials (Z-3 allotment symbol). In this way the smaller manufacturer is given preference in getting on the order books of suppliers over larger plants reconverting to general unprogrammed civilian production.

In contrast to the special assistance this regulation gives to smaller manufacturers after July 1, 1945, the great bulk of new civilian production will be unrated and will not have the advantage of any special allotments.

Mr. Krug, in speaking of the business and labor affected by this order (PR-27),

Illumination Panel at recent Chicago War Production Conference was in charge of (L to R) E. E. Elliott, chairman, Chicago Section, I.E.S. (sponsoring group); Carl Zersen, manager, Chicago Lighting Institute (chairman); and speakers: C. M. Laupp, illuminating engineer, Wisconsin Electric Power; O. N. Collar, illuminating engineer, Commonwealth Edison Co.; L. V. James, lighting and seeing specialist, General Electric Co., Chicago.

explained that according to the 1939 census of manufacturers and data collected in connection with the Production Requirements Plan, manufacturing establishments with annual sales of less than $200,000 accounted for approximately 82 percent of the total number of all manufacturing plants and that they produced about 13 percent of the total value of manufacturing products. About 19 percent of the total number of wage earners employed in all manufacturing establishments are represented in the $50,000 per quarter figure.

The WPB Chairman also discussed the possible spread in these percentages if the order were extended to cover manufacturers, 20 percent of the total value per quarter. They would then comprise 88 percent of the total number of manufacturers 20 percent of the total value of production and represent 28 percent of the total of wage earners employed. In terms of steel, however, a doubling of the dollar limit would probably mean a sevenfold increase in the quantities of materials affected. For this reason, he said, WPB is strongly opposed to such an increase, since this inflation in ratings might nullify the benefits for the smaller plants that the regulation was designed to assist.

Mr. Krug pointed out that the two special exemptions—one covering small-order exemptions in allocation controls and the other the exemption of small plants from some restrictions in production authorization—were designed while the two-front war was still in progress, but are being continued. Both primarily benefit small business and contribute to administrative simplicity. They are designed to free small producers from burdensome paper work to the greatest possible extent. The WPB Chairman also emphasized that both exemptions are being liberalized and have been raised substantially for many of the materials still under general allocation.

Industrial inventory controls were amended on V-E Day to permit stockpiling of the minimum amounts of materials needed in anticipation of starting or resuming civilian production. The amendment carries the provision that the stockpiled materials be obtained without priorities assistance, Mr. Krug said. WPB does not intend to permit hoarding, preemptive buying or buying ahead of needs for production during the transition period, he said. General inventory controls will be continued and specific controls will remain in force to prevent unnecessary shortages in materials in very short supply (tin, crude rubber, lead, allocated chemicals, etc.).

On the other hand, Mr. Krug told the Senatorial committee, a manufacturer is permitted to order and receive minimum production runs, in determining a practicable minimum inventory, in those cases where the smaller quantities needed by him cannot be obtained. This obviously liberalizes inventory control in the case of small business, he said.

Limitation controls on wholesale and retail inventories (Orders L-63 and L-219) are designed to assist smaller retail and wholesale establishments whose sales are less than $200,000 annually, or

Collyer

HEAVY DUTY RUBBER SHEATHED

Portable Cable

Hard blows, reeling and unreeling, heat and abrasion are all in the day's work for Collyer Heavy Duty Rubber Sheathed Portable Cables. On cranes, elevators, electric shovels; for conveyors, dredges and excavating machinery — wherever abrasion, oil, grease and chemicals destroy ordinary cables—Collyer Rubber Sheathed Cables provide dependable, reliable service. Available in Single and Multi-conductor, Type W, Type G and other special constructions.

NOTE THESE OUTSTANDING FEATURES

1 Rope-stranded, tinned copper wires for desired flexibility...resist both tension and torsion.

2 Heat-resistant synthetic rubber insulation...safe for heavy overloads.

3 Multiple conductors cabled with jute fillers...flexible, easy to handle.

4 Rubber cushioning belt, highly resilient, with reinforcing open twine braid.

5 Lead-cured neoprene rubber sheath—dense, tough...resistant to flame, chemicals, oil and physical abuse.

Let us know your requirements.

Collyer INSULATED WIRE CO.

247 ROOSEVELT AVE. PAWTUCKET, R. I.

MINES
Cable Connectors
Portable
Stationary
For Power Transmission
Single or Multi-Conductor
Heavy Duty
Water Sealed
Molded Rubber or Synthetic
Can Be Molded at Factory to Specifications on Your Cords or Cables
Stand Rough Handling and Difficult Conditions
Capacities from 5 to 500 Amperes
Voltages Up to 5000
Carried in Stock in Standard Designs and Sizes and Can Be Made Up Special to Meet Your Specific Requirements.
Write for Bulletin MC-106, showing many successful applications of Mines Connectors throughout industry.
MILLER
ECONOMICAL EFFICIENT ADAPTABLE AND SAFE
MINES EQUIPMENT COMPANY
4231 Clayton Avenue
St. Louis 10, Missouri

whose inventories total less than $50,000. Order L-63, which covers building materials, hardware, automotive supplies and other "hard goods," does not apply to anyone whose inventories are under $35,000. This means that the restrictions on purchasing and inventories in distribution channels limit only large holdings where unbalanced distribution would have serious effects on the economy as a whole and might threaten the supplies of smaller distributors.

—Book Review—

HOME WIRING HANDBOOK

Wiring contractors, architects, builders, and financial institutions will find the new Home Wiring Handbook a comprehensive reference book. It has been written to simplify planning of modern wiring systems for homes within the popular price range.

Homes have been divided into four groups in this new handbook. These four groups cover varying gradations of electrification of the home. Complete wiring details are covered for each group. These details include recommended electrical equipment, both fixed and portable, number of outlets needed for each room, circuits required, control centers, feeders and service entrance, type of circuit protection, signal systems, telephone and radio. In addition, it contains a suggested specification, explains how to apply the handbook to a specific problem, and has a chapter devoted to definitions, miscellaneous charts and tables. Its 120 pages are illustrated with over fifty diagrams and illustrations.

This handbook is based on the present nationally accepted standards of the National Electrical Code. It will be kept up to date by revision of sheets to meet any changes made in the Code. Revision sheets will be mailed to purchasers of the handbook.

Wire bound, with artificial leather cover, it is published in a handy size of 5½ by 8 inches. Its author is A. Carl Bredahl, Technical Director, Better Homes Department, Westinghouse Electric Corporation. Referred to as B-3510, Home Wiring Handbook is available at a production cost of $1.00 from Industrial Relations Department, Westinghouse Electric Corporation, 306 Fourth Avenue, Pittsburgh, 30, Pennsylvania.

PROBLEMS IN ENGINEERING DRAWING

Engineering students, draftsmen, and the hundreds of students trained in drafting and design for war industries, will instantly recognize the value of carefully selected engineering drawing problems in aiding them to improve their training and application of industrial experience.

The author of this set of problems has keyed his selection to Thomas E. French's "Engineering Drawing", sixth edition. The problems have been thoroughly tested in the classroom, and provide a range from the elementary to the more difficult.

A few formal lettering exercises have been included, since good lettering is considered an essential part of an engineering drawing. Additional problems and work sheets include (1) problems relating to useful geometric constructions, (2) problems that afford an opportunity to develop the student's ability to visualize and think in three dimensions, and (3) translation exercises, from pictorials to orthographic drawings, and from orthographic drawings to pictorials, selected to build confidence in an understanding of the fundamentals of projection.

Because industry continues to make considerable use of isometric and oblique drawings as an aid in interpreting orthographic drawings, sketching is stressed.

How instruments tell the whole story is outlined to a group of electrical maintenance engineers at the recent Milwaukee E.M.E. Industrial Electrical Exposition by M. F. Jacobs (left), M. F. Jacobs Co., Milwaukee, distributors of electrical instruments.

Cross-section and isometric graph sheets are included in the book as an aid in developing skill in sketching.

Problem sheets on conventional practices employ current recommendations of the American Standards Associations. There are also studies in auxiliary views, sections, and dimensioning. The sheets on dimensioning include typical exercises and problems relating to the dimensioning of pictorial drawings.

Cloth bound, the book is equipped with a special wire ring which permits work sheets to be removed. Each page is also perforated and punched for a three-ring binder. Size of sheets is 8½ by 11 inches. There are 52 work sheets, in addition to the instruction sheets and problem assignments.

The book is Problems in Engineering Drawing, Series I, by A. S. Levens and A. E. Edstrom. It is published by the McGraw-Hill Book Company, 330 West 42nd Street, New York, 18, New York. Price $2.50.

MANUFACTURERS NEWS

G-E PROMOTIONS

Three well known sales executives at General Electric's Nela Park have been advanced to new posts as part of a reorganization program affecting home office operation of the G-E Lamp Department. They are O. H. Young, W. H. Robinson, Jr. and E. D. Stryker.

O. H. Young, who has been sales manager of all photolamp activities, will continue in that capacity. In addition, however, he will assume new duties and responsibilities assigned to him as part of the lamp department's eastern sales division activities.

W. H. Robinson, Jr. has been named sales manager of electric discharge lamps. He has been active in all recent fluorescent activities conducted by G-E Lamp Department and will continue in that work. In addition, he will be responsible for similar work on all other electric discharge lamps except the germicidal and glow types.

E. D. Stryker has been named sales manager of lighting equipment promotion. In his new responsibilities he will continue his activities with fixture manufacturers and take on such other duties and responsibilities as may be assigned to him.

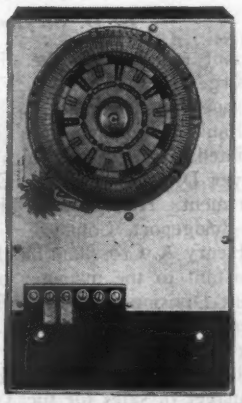
A. L. Scaife has been appointed advertising and sales promotion manager of G-E's appliance and merchandise department. Mr. Scaife, who succeeds B. W. Bullock, who has resigned, will also continue to serve as merchandising manager. In his new capacity, he will be in charge of all advertising, sales promotion and merchandising plans connected with the sale of G-E major appliances, traffic appliances and construction material. As-

LET "MR. TOPS" CONTROL YOUR TIMING of

Automatic HEATING, VENTILATING, LIGHTING, PUMPING OR FLUSHING OPERATIONS

Paragon 700 Series Time Switches are equipped with 6" calendar dials which make one complete revolution every 7 days. Dial trippers can be independently set for different daily ON and OFF schedules. Settings can be made in advance for an entire week. Any day or days operations may be omitted entirely on a pre-set program.

Each day of week clearly separated from other days; graduated into hours and half hours; day and night distinctly separated. Operations from ON to OFF or from OFF to ON can be set as close as three hours apart and can be separately adjusted throughout each 24 hour day in the week.



Paragon 700 Series Time Switch

Write for a complete engineering bulletin.

PARAGON ELECTRIC COMPANY
710 Old Colony Building
Chicago 5, Illinois

SEE YOUR JOBBER

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1903

Without disturbing Conduit

Only with Kondu can you take out one fitting and put in another, without disturbing conduit. Every Kondu box is a union.

Only with Kondu can you use ANY kind of conduit at ANY outlet.

Vibration - proof, Kondu holds permanently tight. Practically unbreakable — 100% re-usable. *Write for the Kondu Catalog.*

KONDU CORPORATION
Erie, Pa.

KONDU MFG. CO. LTD., Preston, Ontario

KONDU

The Threadless Fitting Line of Unequalled Variety

O. H. Young

W. H. Robinson, Jr.

E. D. Stryker

sistant manager of the division will be George B. Park and E. F. Vickery will be operating manager.

Paul L. Chamberlain has been appointed manager of sales for the Receiver Division of G-E's Electronics Department. He will make his headquarters at Bridgeport, Conn.

Henry A. Crossland has been appointed assistant to the manager of the Government Division of the Electronics Department. He will be located in the Washington D. C. office.

James D. McLean has been appointed manager of sales for the Transmitter Division of the Electronics Department. He will have headquarters at Schenectady.

C. W. Hackenyos has been appointed a district electronics representative in the Atlantic District with headquarters at Philadelphia.

C. A. B. Halvorson, consulting engineer for the G-E Lighting Division at Lynn, Mass., and one of the outstanding leaders

BETTER LIGHTING IS A NATURAL RESULT WITH MULTI Reflectors

INDUSTRIAL REFLECTOR

• All time favorites . . . that's the way contractors feel about the MULTI line. They have good reason too—MULTI is complete—they can get the proper unit for any type of installation—maintenance is simple—no after worries. Here is your modern, flexible line of Reflectors that gives long - time service and better lighting.

• Send for Complete Catalog

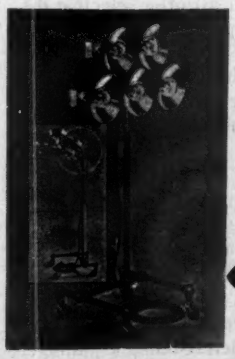
MULTI
ELECTRICAL MANUFACTURING CO.
1840 W. 14TH ST., CHICAGO 24, ILL.

INFRA-RED RAY

DRYING • BAKING • DEHYDRATING

Radiant Energy, The Modern Method Cuts Drying Cost, Saves Time, Uses Minimum Space, Produces Uniform Results with

NALCO CARBON FILAMENT Lamps



Use Nalco Drifrara Lamps for efficient results . . . available in Inside-Silvered (self-reflecting) or clear glass types.

Learn all of the advantages of the Infra - Red Process—Write for your free copy of "Drying Problems Made Easy" today.

←Illustrated a five-light portable adjustable Nalco Unit with gold-plated Reflectors.

NORTH AMERICAN ELECTRIC LAMP CO.
1044 Tyler St. St. Louis 6, Missouri

pany. He is holder of more than 100 lighting patents, including the G-E sodium, mercury and Form 79 incandescent luminaires, and invented the control mechanism which allowed the famous luminous arc lamp, developed by the late Dr. Charles P. Steinmetz, to be placed on the market in 1903. He later developed the ornamental luminous arc lamp for "white way" business street lighting, introduced by him in 1910.

A new building for the General Electric Company's Research Laboratory, which will afford some 50 percent more space than present facilities provide, will be erected near Schenectady at a cost of $8,000,000, it was announced recently by Charles E. Wilson, president. Construction will begin as soon as WPB approval can be obtained.

ALLIS-CHALMERS APPOINTMENTS

J. C. Schaefer, field engineer of the Allis-Chalmers Pittsburgh district office, has been appointed branch office manager at Youngstown, Ohio. He will succeed E. H. Legler, who has been transferred to the electrical department at Milwaukee, Wis.

L. E. Stacey, field engineer of the Pittsburgh district office, has been transferred to Wheeling, W. Va., as a resident field engineer.

Grant M. Hinkamp has joined Allis-Chalmers as an industrial engineering specialist. He was formerly with the Stone & Webster Engineering Corporation.

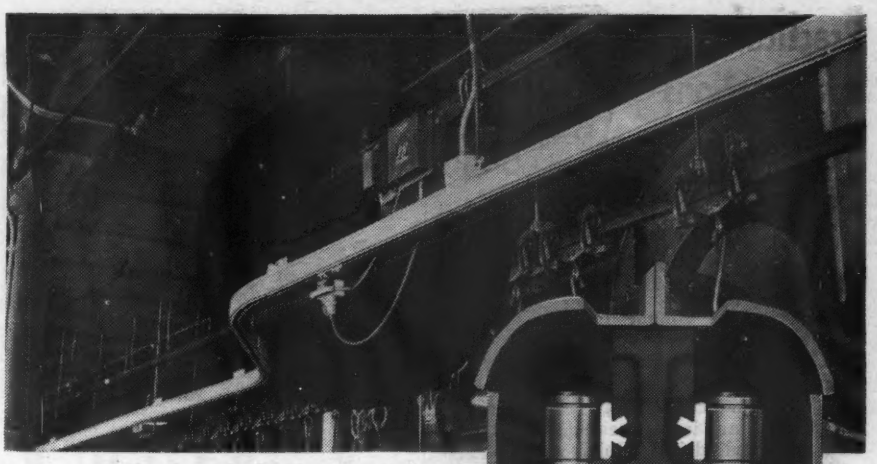
Charles F. Codrington has been appointed assistant to the manager and A. E. Caudle has been named sales manager of the Blower and Compressor Department.

WESTINGHOUSE APPOINTMENTS

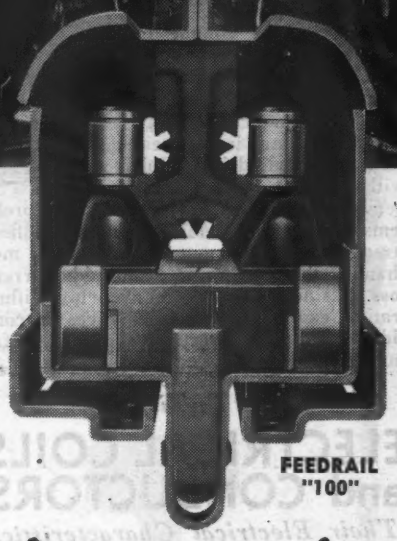
The Board of Directors of Westinghouse Electric Corp. has elected three vice presidents to head the treasury, law and patent departments, and lamp manufacturing and lighting equipment divisions. They are L. H. Lund, who has been treasurer since 1941; William E. Miller, who had been general attorney in charge of the law and patent department since 1944, and Ralph C. Stuart, in charge of the Lamp and Lighting Divisions.

Mr. Lund and Mr. Miller have their offices in Pittsburgh. Mr. Stuart will administer the four plants of the Lamp Division at Bloomfield, Belleville and Trenton, N. J. and Fairmont, W. Va., and the Lighting Division's Cleveland plant from the Lamp Division headquarters at Bloomfield.

Frank W. Godsey, Jr. has been appointed manager of the New Products Division. Mr. Godsey replaces G. H. Woodard, who has been transferred to South Philadelphia as manager of the Aviation Gas Turbine Division. His



ELECTRIC FEEDRAIL



FEEDRAIL "100"

—Adaptability

You tell us where, and we will tell you how Electric Feedrail can serve your cranes, hoists, movable tools, lights or test lines.

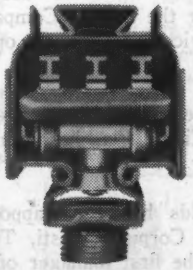
Electrification of curves, transfers, turntables for cranes and hoists are all in the day's work for Feedrail.

When you plan production layouts, you can get more production from fewer portable tools such as drills, reamers and polishers by using Electric Feedrail. Fixed outlets and long cords are eliminated. You just slide the electrical equipment along overhead and bring it down to the work.

Electric Feedrail is built for continuous heavy duty service. Bus bars are enclosed and protected against dust, shorts, and mechanical injuries.

Workers are protected from dangerous contact with exposed live parts.

Why not ask us to send an engineer to look over your plant layout?



FEEDRAIL "60"

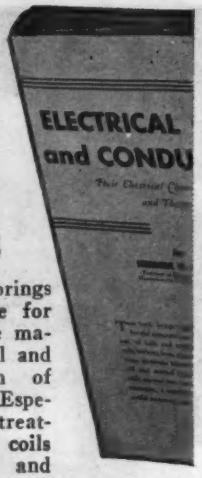
ASK FOR ELECTRIC FEEDRAIL CATALOG NO. 15

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company

125 BARCLAY STREET • NEW YORK 7, N. Y.

Practical computations for electrical coils and conductors



This valuable book brings together in one volume for the first time extensive material for the theoretical and numerical computation of coils and conductors. Especially important is the treatment of cylindrical coils without iron cores, and heavy conductors. Among the many problems taken up in detail are magnetic field strength, self- and mutual inductance, mechanical force, skin effect and eddy-current loss. Besides including many helpful illustrative examples, the book gives a considerable number of curve sheets of useful numerical values.

Just Published

ELECTRICAL COILS and CONDUCTORS

Their Electrical Characteristics and Theory

By HERBERT B. DWIGHT
Professor of Electrical Machinery, Massachusetts Institute of Technology

348 pages, 5¼ x 8¼, 85 illustrations, $5.00

H. B. Dwight's work in electrical problems is well known in engineering circles. Now this authoritative material on the theory and practice of electrical coils and conductors, with extensive reference material, is easily available in this important new book.

This book places at your fingertips the equipment you need for complete, accurate computations—both theoretical and numerical—for every type of electrical coil and conductor.

Full data on these important problems:

- Magnetic field strength
- Self- and mutual inductance
- Mechanical Force
- Eddy-current loss

with closely related material on

Bus bars, cables, and other variously shaped conductors
Ground resistance
Heat transfer
Proximity effect
Reactance curves
Cable and wire sizes
Skin effect
Sag calculations
Strap conductors
Armature windings
Graphical flux plotting

For its precise descriptions of electrical characteristics, its hundreds of formulas and computations, its useful tables and diagrams, its curve sheets, illustrative examples, etc., *this is the book on electrical coils and conductors you have been looking for!*

SEE it 10 days • SEND this coupon

McGRAW-HILL EXAMINATION COUPON

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. 18

Send me Dwight's Electrical Coils and Conductors for 10 days' examination on approval. In 10 days I will send $5.00, plus few cents postage, or return books postpaid. (Postage paid on cash orders.)

Name .....

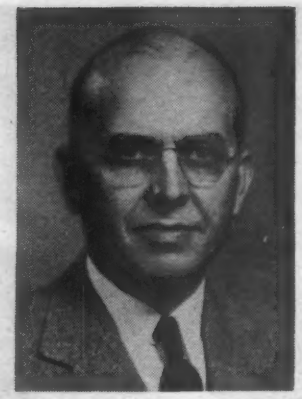
Address .....

City and State .....

Company .....

Position .....EC 7-45

(Books sent on approval in U. S. only.)



R. C. STUART

headquarters will be at the Pittsburgh office.

C. E. Stephens, vice president, has retired from active service with Westinghouse after 45 years of service. After several years of work as an apprentice and engineering student. Mr. Stephens entered the engineering department where he worked on the development of motors. After a short time on this work he was made manager of the arc lighting section of the engineering department and later made manager of the illuminating section of the sales department. In 1917 he was transferred to the New York Office as manager of the supply department. Later he was made manager of the central station division of the New York Office and in April 1925, was made manager of the New York district. In 1930 he was elected commercial vice president in charge of the districts in the Atlantic Division. In 1932 he was elected vice president of the company, in which capacity he served until his retirement.

WESTINGHOUSE SUPPLY CHANGES

Announcement has been made of the appointment of John A. Vassar as general service manager of the Westinghouse Electric Supply Company. Mr. Vassar will have offices in New York. He will be responsible for the Supply Company's nation-wide service department operations, including home appliances and radios.

Charles R. Lee, formerly manager of the Branch in Miami, Fla., has been appointed manager of the New Orleans Branch.

C. M. Reynolds has been appointed manager of the Corpus Christi, Texas, branch. He is the first manager of this branch.

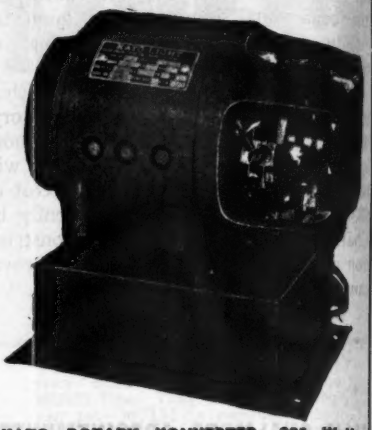
L. J. Clay has been named manger of the San Antonio, Texas branch. He joined the company the first part of this year.

The appointment of G. H. Lineberry as apparatus and supply manager for the Pittsburgh District has been announced.

Albert L. Wiegenstein has been made apparatus and supplies manager for the North Pacific District. He will make his headquarters in Seattle, Wash.

110-Volts A.C. from Direct Current

with KATOLIGHT ROTARY KONVERTERS Change 32, 110 or 220 volts D.C. to standard 110-volt, 60-cycle A.C. for operating radios, electronic & sound apparatus, electric signs, A.C. appliances, etc.



KATO ROTARY KONVERTER, 225 Watts
Pioneers in the Building of Small Rotary Converters

At present Kato's entire production must be directed to furnishing converters on priority orders.
Also manufacturers of A.C. and D.C. generators ranging from 350 watts through 25 K.W.; power plants; Frequency Changers; and Motor Generator Sets.

KATO ENGINEERING CO.

645 N. Front St., Mankato, Minnesota

SOLAR *Electrical Products*

Quotation on request

SOLAR ELECTRIC CORPORATION
WARREN, PENNSYLVANIA

RCA ELECTIONS

Frank M. Folsom, who has been vice president in charge of RCA Victor Division since January 1944, was elected executive vice president in charge of RCA Victor Division at a recent meeting of the Board of Directors. At the same time John G. Wilson was elected operating vice president of RCA Victor Division.

Mr. Folsom joined RCA after serving in Washington as Chief of the Procurement Branch of the Navy Department. In addition to being in charge of RCA's manufacturing division, he is a director of RCA, and of the National Broadcasting Company.

Mr. Wilson has been in charge of Financial Administration of the RCA Victor Division for the last year. He came to RCA from Chicago where he had been executive vice president of the United Wall Paper Co.

EXECUTIVE CHANGES AT ROBBINS & MYERS

Following notification by C. H. Clark, vice president, that he will retire at the end of this fiscal year, the Board of Directors of Robbins & Myers, Inc. has announced three executive changes effective immediately.

A. W. McGregor, who joined the Production Control Department in 1919, has been elected executive vice president, F. W. Smith, who started as an engineer in the Motor Division in 1911, has been elected vice president, and W. J. Helmer, who has been a salesman since 1916, is now general sales manager. Headquarters for all will be at the home office in Springfield, Ohio.

SQUARE D TO OPEN PLANT IN MEXICO

F. W. Magin, president of Square D Company has announced that the formation of Square D de Mexico, S. A., to manufacture electrical distribution and control equipment for the Mexican market is in process of completion. Square D de Mexico will be owned jointly by the United States Company and prominent Mexican industrial leaders who have broad experience in Mexican electrical requirements, Mr. Magin said.

Officers of the company will be residents of Mexico, according to Mr. Magin. He and L. W. Mercer, vice president and general sales manager of the domestic company, will represent Square D Company on the board of directors.

A plant equipped with the latest type of American machinery will be built in Mexico City, DF., as quickly as arrangements can be completed, Mr. Magin said.

FULLMAN Latrobe PRODUCTS

FLOOR BOXES — WIRING SPECIALTIES

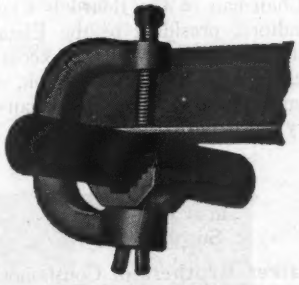
FULLMAN MANUFACTURING CO. QUALITY AT LATROBE TO SUPREMACY LATROBE, PA.

Make Fullman Your Source of Supply for Floor Boxes and Wiring Specialties

Fullman "Latrobe" Products have performed efficiently and economically during the war emergency and can be depended upon to maintain leadership in the approaching long swing peace market.

No. 130 Floor Box
Right for use in concrete and wood finished floors. Quickly installed, watertight and lasting.

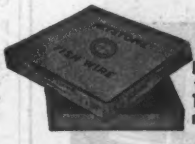
No. 284 Nozzle
Duplex Receptacle Nozzle with ½" brass pipe extension. Very compact. Also furnished with ¾" pipe extension.



No. 470 "Bull Dog" Pipe or Conduit Hanger
Economical and efficient for hanging ½", ¾" and 1" pipe or conduit to steel beams up to ⅝" thick. Made of high grade malleable iron.

No. 480 "Bull Dog" Armored Cable Support
Convenient for installing armored cable in factories or other buildings of steel construction. Permits cable to run at any angle.

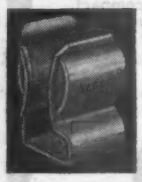
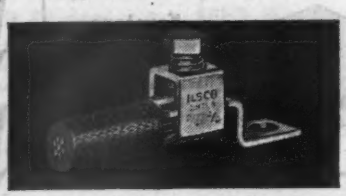
"Bull Dog" Insulator Supports
For fastening porcelain or glass insulators to exposed steel framework. Four sizes.



Keystone Fish Wire
Dependable quality flat steel wire. Tempered exactly right. Ten sizes.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

There Is
A Profit For YOU
In Automatically
Turning ON and OFF
ELECTRIC SIGNS —
LIGHTING SYSTEMS
And Dozens of Other Applications with the
2200-Watt AUTOMATIC
Self-Starting TIME SWITCH
Single Pole—MODEL 120
$12.00
Why buy LESS
when you get the MOST
in AUTOMATICS
Prices Subject to Usual Discount & Terms
Write for Information
AUTOMATIC
Electric Manufacturing Co.
TIME SWITCHES—FLASHERS
MANKATO • MINNESOTA


Ilsco
ELECTRICAL
CONNECTORS
WHAT WE SAVE IN WEIGHT
YOU SAVE IN COSTS
Most value per dollar . . . most service and satisfaction. Figure it out . . . you're way ahead because ILSCO PRODUCTS are
12% cooler
50% lighter
75% lower price
99% pure electrolytic copper
100% conductivity

Write for 32-page illustrated catalog.
ILSCO COPPER TUBE & PRODUCTS, Inc
CINCINNATI, OHIO

ILG NAMES FOUR NEW SALES ENGINEERS

The Ilg Electric Ventilating Company of Chicago, Ill, has opened new branch offices in Grand Rapids and Knoxville and appointed new sales engineers in Dallas and Philadelphia.

The newly appointed Dallas sales engineer is Marvin Gardner. Before joining Ilg he was the head of the ventilating department of the Ingalls Shipbuilding Corporation, Pascagoula, Miss.

George A. Innes has been appointed a sales engineer under C. Warner Smith manager of the Philadelphia Office.

The new branch office in Knoxville. Tenn. is under the direction of Roy H Mackay, who for the past four years acted as associate engineer for the U. S Bureau of Reclamation, Washington, D. C.

J. W. Pulte has been named manager of the Grand Rapids, Mich. branch. Before joining Ilg, he was field engineer in Western Michigan for the Detrex Corporation, Detroit.

BUCHANAN RESEARCH LABORATORY REORGANIZES

Stephen N. Buchanan has incorporated the Buchanan Research Laboratories, with offices at 2 West Jersey Street, Elizabeth, N. J. All of the business of the former Laboratory of Newark, N. J. has been taken over by the new corporation. Mr. Buchanan is president and heads the new corporation's research and development projects in the field of radio, telephone, television, aircraft and general commercial wiring uses.

Chairman of the Board is Clarence R. Sandford, president of the Elizabethport Banking Company and executive vice president is Frank C. Sterck, who has been associated with Buchanan Laboratory since 1941.

•

Walker Brothers of Conshohocken, Pa. announces the appointment of C. A. Scott as vice president in charge of Wire Mill Operations. Mr. Scott is well known in the electrical construction field having been connected with the Insulated Wire Division of the B. F. Goodrich Company, sales manager with the Buffalo factory of the Rome Wire Corporation, later General Cable Corporation, and for the past nine years with the Rome Cable Corporation as executive vice president.

•

Sylvania Electric Products Inc. announces the appointment of Edward G. Adams Jr. of Roslindale, Mass. as assistant advertising manager of the Lighting Division of Sylvania. He will be in charge of the Advertising Department at Salem, Mass.

Contains detailed descriptions of models we're now making.
We manufacture Volt-Ohm Milliammeters, Insulation Testers, Signal Generators and Tracers, Industrial Analyzers, Voltage Testers, etc.
SUPERIOR INSTRUMENTS CO.
Dept. 156
227 Fulton St. New York 7, N. Y.

ENGINEERS WANTED
Here's an opportunity to join one of America's largest manufacturers of electronic and communications equipment.
Radio
•Electrical
Electronic
Industrial
(Job evaluation)
•Mechanical
•Factory Planning
Materials Handling
Manufacturing Planning
Work in connection with the manufacture of a wide variety of new and advanced types of communications equipment and special electronic products.
Write giving full qualifications, or apply to:
R. L. D., EMPLOYMENT DEPT.
Western Electric Co.
100 CENTRAL AV. KEARNY, N. J.
• Also: C. A. L.
Locust St. Haverhill, Mass.
Applicants must comply with WMC regulations

Graybar Electric Company, Inc. has appointed J. F. Lee merchandising manager in Metropolitan New York and Northern New Jersey. He will make his headquarters at 180 Varick Street, New York. J. P. Darcy will assist Mr. Lee in his new duties.

•

The Aerovox Corporation in New Bedford, Mass., has named Frank L. Marshall to its sales staff. He was formerly assistant sales manager of Bundy Tubing Company of Detroit.

•

The Waring Products Corporation, one of the subsidiaries of Reeves-Ely Laboratories, Inc., has taken offices at 331 Madison Avenue, New York City.

•

Copperweld Steel Company has transferred Fred Brown, New England sales engineer to the home office at Glassport, Pa., where he will assume the duties of staff engineer in the General Sales Department.

H. M. MacDougal has succeeded Mr. Brown in the New England territory. He has been in the Sales Engineering Department of Copperweld at Glassport.

•

The Oliver Iron and Steel Corporation of Pittsburgh, Pa. has appointed A. L. Perdue as Northern California district representative. Mr. Perdue was formerly lighting specialist in San Francisco for the Westinghouse Electric Supply Company. He has established his office at 260 Fifth St., San Francisco, Northern California district headquarters of the Westinghouse Electric Supply Company, distributors for the Oliver concern.

•

Faraday Electric Corporation has announced the appointment of Charles L. Hobbs as assistant general sales manager. For the past year and a half Mr. Hobbs has acted in the capacity of Chicago Branch Manager. He will make his headquarters at 11 South LaSalle Street, Chicago.

•

Bentley, Harris Manufacturing Company of Conshohocken, Pa., has moved its Chicago office, formerly located at 440 West Huron Street to 43 East Ohio Street.

The Boston office, 10 High Street, is now in charge of Frank W. Garner.

SORGEL AIR-COOLED TRANSFORMERS

for Contractors

and Industrial Applications

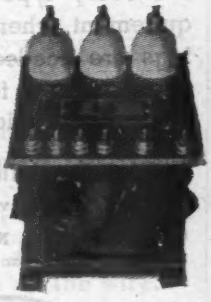
1 KVA. 3-phase

Priced according to a FAIR sales policy.
Designed liberally for continuous service.
Constructed for economical installation—wall or floor mounting; no extra brackets.

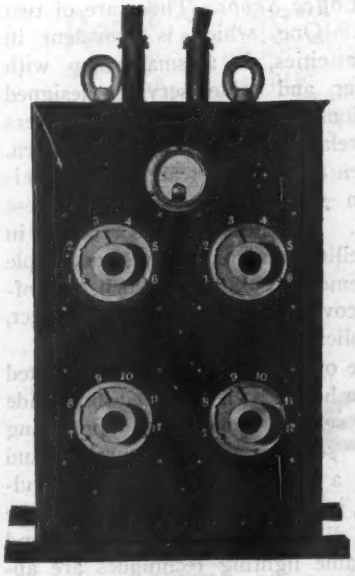
Standard 15 KVA
1-phase
Wall Mounting Type

A large variety of standard types and special transformers to meet special requirements

¼ to 1000 KVA
All voltages
Single phase and poly-phase



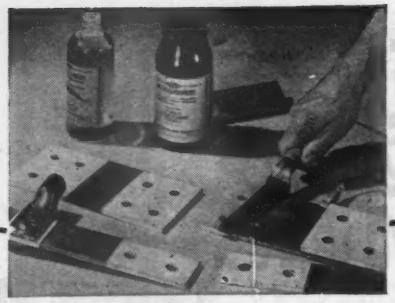
Special
Electronic device
Transformer



Special Furnace Transformer with adjustable tap changing switches

Standard 75 KVA. 1-phase
Floor Mounting Type

SORGEL ELECTRIC CO., 836 W. National Ave., Milwaukee 4, Wis.



RAPID

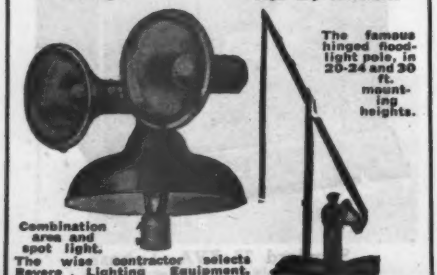
SILVER COATING EQUIPMENT

For every type electrical requirement where silver coatings are needed! Also other metals. Write for folder! Or, call nearest office.

RAPID ELECTROPLATING PROCESS, INC.
1414 S. Wabash Ave., Chicago 5, Ill.
621 Graybar Bldg., New York 17, N. Y.
237 Rialto Bldg., San Francisco 5, Calif.

RAPID

"THERE'S NOTHING BETTER"



The wise contractor selects Revere Lighting Equipment. It's the most complete line—saves his time makes satisfied customers.

Write for catalog

REVERE ELECTRIC MFG. CO.
6017 BROADWAY • CHICAGO 40, ILL.

Lighting Techniques For Restaurants [FROM PAGE 71]

therefore, know color quality of the many light sources available, and be able to select the proper light source to complement the work of the decorator. (Color quality of light sources was discussed in the first article of this series, published in the January, 1945 issue of *Electrical Contracting.*)

Some of the more popular *lighting techniques* which may be used in restaurants and cafes, and which will successfully combine light with architecture and decorators, are shown in Figs. 2 to 7 inclusive. Many others can be created, to meet specific architectural or decorative treatments as they are encountered. Again, it is stressed that it is important to know the light sources which are available. It is important to know the physical size, spectral quality, and lumen output of the light sources and the types of sockets, lampholders, wireways, transformers, etc. necessary for the operation and the installation of these lamps. It is also important to know what accessories, such as diffusing glass lenses, plastic sheets, color hoods, etc. are available. With a full knowledge of these lighting devices, many new and unusual decorative effects can be worked out. The practical value of these unusual applications of light lies in the ability to create unusual decorative effects of a restful and pleasing nature. These in turn will attract and make satisfied customers.

5. *Coffee Shops.* These are of two types. One, which is prevalent in larger cities, is a small shop with counter and table service, designed functionally to handle many customers in a relatively small square foot area. Fifteen or more footcandles of illumination should be provided in these shops. Incandescent units recessed in the ceiling, augmented by some simple supplementary lighting, such as coffers, coves, etc., for ornamental effect, is applicable to these small shops.

The other type is usually associated with a hotel. It is designed to provide faster service than normal main dining room service. Architecturally, and from a decorative treatment standpoint, it is similar to restaurants of the types discussed in item 4 above, and the same lighting techniques are applicable for providing an adequate and comfortable lighting result.

6. *Main dining, banquet and supper rooms.* This class of dining area is usually associated with a hotel, club, or institution, such as a private school.

How to select • operate • maintain the *right* controllers for your electric motor power

Here is your controller guide for selecting and using the control apparatus that will best harness your electric motor power to your load requirements. This book takes the guess-work out of control purchase and presents the operator with all the facts on controller operation and design. Hundreds of diagrams, illustrations, curve charts and tables, together with a simple, direct text, instruct operating men, engineers, purchasers of control on each detail of proper selection, operation and maintenance.

Just Published!

CONTROLLERS FOR ELECTRIC MOTORS

By HENRY DUVALL JAMES
Consulting Engineer, Pittsburgh, Pa.
and LOUIS EDWIN MARKLE
Design Engineer
324 pages, 6½ x 9¾, 276 figures, 6 tables, $3.50

This book brings you up to date on the latest control apparatus—new uses of the electron tube, magnetic contactors, time-limit method of acceleration, development of plugging control, and of the Regulex, Ampledyne and Rotorol, and new types of time-delay overload relays. Here is analysis of popular commercial types, and most successful methods of accelerating motors, speed control, mechanical and dynamic braking, regeneration, and voltage control for d-c motors, with special sections on protective devices, national codes, installation and maintenance, and future control developments.

Detailed information on:
Functions, types, advantages and limitations of magnetic contactors
De-ion principle of arc rupturing
Use of two power tubes to give more uniform d-c power
Time-limit methods of accelerating motors
Motor-generator control of motor voltage
New types of time-delay overload relays

• There is a section on how to read controller diagrams, and a section devoted to future control developments describes new developments from World War II, electron-tube control, variable frequency, hydraulic gear, the use of telephone devices and practice, radio signals, etc.

See it 10 days • Send this coupon

McGRAW-HILL EXAMINATION COUPON
McGraw-Hill Book Co., 330 W. 42 St., N. Y. C. 18

Send me James and Markle's Controllers for Electric Motors for 10 days' examination on approval. In 10 days I will send $3.50, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Company .....
Position ..... EC 7-45

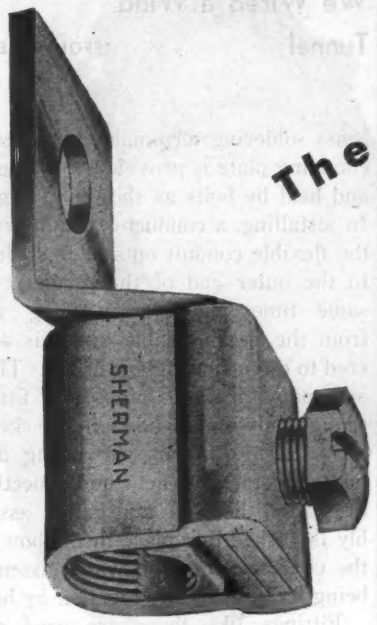
Practice is to create a dignified, stately and refined atmosphere in this class of dining room. The majority of the older rooms are of traditional design. Lighting fixtures should harmonize with these architectural details. When the lighting fixture design will permit, concealed or well shielded light sources should be incorporated in the fixtures to provide the desired lighting result. If adequate lighting cannot be obtained from these fixtures, other techniques should be used to provide a uniform lighting intensity. Such techniques may involve coves, wall urns, recessed lens units, or concealed pinhole type spotlights.

7. Bar-Cafes. Public dining areas which specialize in food and drinks are covered by this classification. Bar-cafes consist of a main dining area, and a bar for mixing and serving liquors, cocktails, wines and beer. The bar may be the feature attraction, or may serve as an accessory only. The bar should be accentuated with light to create a feeling of life and sparkle when it is the feature attraction. The effect should be one of cheerfulness and sunlight, but without the effect of glare. Light sources having an abundance of yellow and orange radiation, properly concealed, will produce this effect.

Lighting techniques which have already been discussed in item 5 are suitable for lighting the dining area of bar-cafes.

8. Night Clubs. The typical night club features dining, dancing and entertainment. It is usually a show place, with much emphasis put on decorations. Lighting can play its part here, by adding color and sparkle as desired. Flexibility in lighting intensities and lighting effects is the keynote throughout. Spot and floodlights, both with and without color frames, should be provided to light the dance floor. Equipment should be provided which will produce a uniform illumination of ten footcandles of undistorted color quality throughout the entire area. This lighting equipment should be controlled by dimmers, or flexible switching arrangement, to permit varying intensities of illumination. In this way, floor show attractions can be featured, and color effects accentuated.

Every effort should be made in lighting night clubs to provide maximum flexibility in lighting intensities and in lighting results. Best results can be obtained when the lighting equipment and light sources are made inconspicuous, so that the results only are accentuated without the spectator being made conscious of the mechanics involved.



The SOLDERLESS LUG that Speeds Up the Job

Sherman Type S-O Solderless Lug

Part No.	Max. Amp. Cap. N.E.C.	Range Wire Sizes Max.	Min.
SO-8	35	8	14
SO-4	70	4	14
SO-1/0	125	0	3
SO-4/0	225	0000	0
SO-500	400	500M CM	250M CM

Read the Sherman Advertisements appearing in "Wholesalers Salesmen" which urge the entire industry to support and protect the ELECTRICAL CONTRACTOR.

See that big hex head, slotted screw? You can tighten that up with wrench, pliers, or screwdriver — whichever is at hand.

That screw forces a movable pressure plate down on the wire. No chance for the wire strands to separate. The pressure plate, which is the full length of the barrel, compresses the strands—grips them between large, serrated surfaces which insure a connection that is mechanically strong and electrically efficient.

Yes, you can make fast time when you use this big, strong Solderless Lug. What's more, when you're done, you know the job is right.

A lot of good Electrical Contractors are using this Sherman Lug today. They KNOW that it pays!

H. B. Sherman Mfg. Co.
Battle Creek, Michigan

Sherman

Solderless Lugs . . . Soldering Lugs . . . Wire and Cable Connectors . . . Fixture Connectors . . . Ground Clamps and Fittings . . . Electrical Terminals . . . Battery Connectors . . . Splicing Sleeves . . . Wedge Grip Connectors.

Millions of Steel
JIFFY CLIPS
Serving the Electrical Industry

Specify
MINERALLAC
HANGERS, CLIPS, STRAPS, BUSHINGS

Expert design, choice materials and controlled manufacture have built "top-service and longest life" into Minerallac Electrical Specialties. That's why the electrical industry "prefers Minerallac"... in steel and Everdur for hanging pipe, conduit, BX cable, etc.

Send for new literature and prices.

MINERALLAC ELECTRIC COMPANY
25 North Peoria Street—Chicago 7, Illinois

MINERALLAC

ELECTRICAL SPECIALTIES
FOR HEAVY INDUSTRIAL SERVICE
RMC
FROM STOCK

Soldering Lug
3-Conductor Angle Pothead
Single Conductor Pothead

Write for a complete selection of RUSGREEN bulletins

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

RUSGREEN MFG. CO.
14260 Birwood Avenue • Detroit, Mich.

We Wired a Wind Tunnel

[FROM PAGE 63]

brass soldering terminals. A cover or clamping plate is provided covering all and held by bolts as shown by Fig. 2. In installing, a conductor coming from the flexible conduit outside is soldered to the outer end of the pin. At the same time, the corresponding wire from the flexible cable inside is soldered to the inside end of the pin. There are many of these pins to a fitting, though only one is shown in the sketch, from 19 to 31 pins per fitting as a matter of fact. When the connections are made, the plate and gasket assembly is pushed into place in the box and the cover put on, the whole assembly being brought tightly together by bolts.

Fittings like these are used over various parts of the tunnel shell, individually and in groups. The greatest number at any one point are brought in immediately under the working sphere, through a single large pot as shown in one of the photographs.

Double precautions were taken by the contractor in pulling and marking control wires, for in such an intricate system a single error might well cause the loss of much time in remedying the error. Colored wires were not obtainable in sufficient variety, so every conductor was cut to predetermined length and tagged at both ends. After the wires were pulled, every one was tested through by telephone to see that it was connected to the right terminal at the panel.

There are three operating conditions on the main shaft calling for a certain speed control routine. (1) a-c only. (2) d-c only. (3) combined a-c and d-c.

On a-c only, control is through the operator at the console, exclusively, through a remotely controlled liquid rheostat, see Fig. 3. There are three Transite cylinders containing water, one for each of the three phases. Terminals are immersed at each end of the cylinders. The upper terminals are movable, being motor operated and remotely controlled by pushbutton at the console. In that manner, the operator raises or lowers the upper terminals at will, varying the distance, and consequently the resistance between them.

On d-c only, the speed is controlled by the operator at the console through a remotely controlled gang rheostat.

On the combination of a-c and d-c, the d-c is controlled remotely from the

WHERE TO BUY

TORK

TURN ANYTHING ELECTRICAL ON & OFF REGULARLY

The TORK CLOCK CO., Inc.
MOUNT VERNON, NEW YORK

ALLEN FLUX
for SODERING
Silver Soldering
WELDING
L. B. ALLEN CO., INC.
6715 Bryn Mawr Chicago, 31, Ill.

DRILL CONCRETE THE EASY WAY

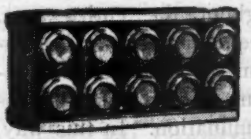
WODACK "DO-ALL"
ELECTRIC HAMMER AND DRILL

Saves time and labor installing expansion anchors. Two motions—reciprocal for hammer drilling—rotary for twist drilling. Drills masonry to 1⅝" dia., metal ⅝". Easy to maintain. Universal motor, runs direct from lamp socket. Weighs 15 lbs. Star drills in 17 diameters. Also chisels, bull points, etc. Ask for bulletin.

Wodack Electric Tool Corporation
4628 W. Huron St. Chicago 44, Ill.
Telephone AUstin 9866

LAMP ANNUNCIATORS

Kirkland Bulls-I-Units are ideal for building lamp annunciators. Just provide the proper size holes in the panel, then insert the Kirkland units and lock into place. Assembly is then ready for installation. Connect incoming wires and place in service.



Write for Catalogue
THE H. R. KIRKLAND CO., MORRISTOWN, N.J.

Burned Out or Broken Electric Heating Elements

repaired with NICHROCITE PASTE. Simply overlap ends, apply paste turn on current. Used by utility companies, etc. Family size, $1.00, 4 oz. size $2.50. Satisfaction guaranteed.
ARMSTRONG Mfg. Co., Box 861F Minneapolis, Minn.

console, but the a-c is an automatic function of the second sequence and additional load is shifted from the d-c motor to the a-c motor automatically.

Among the responsibilities of the electrical contractor was the assembly of the motor generator set supplying direct current to the large direct current motor. This machine was too large to ship as a unit and the various knocked-down parts had to be assembled on the foundation.

In checking the equipment we discovered that one end of the generator shaft had been very slightly bent in the form of a bulge at the bearing point, being out of line in the center of the bend eleven one-thousandths of an inch. Time was an important factor and it was decided to try truing up the shaft by heating the concave side of the bend very carefully with an acetylene torch, to see if the resulting expansion of the metal on that side of the shaft would not bring it back into line. This was done and it worked satisfactorily, bringing the shaft to within 0.001 in. of true.

To those interested in statistics, here are a few.

Over-all length (of rectangle) 179 ft.

Maximum width 72.5 ft.

Maximum diameter, 31.5 ft.

Steel used in fabricating and erecting, 2,500,000 lbs.

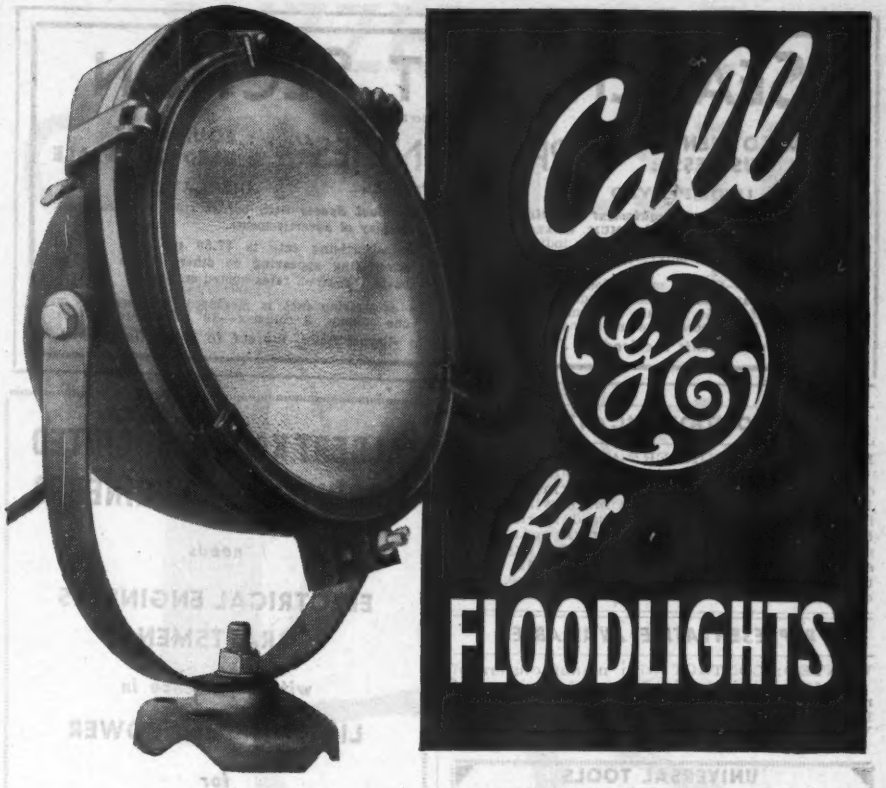
Wind duct required 17 miles of electric-arc welding.

Wall of steel plate almost 1 inch thick.

Air speed, more than 700 miles per hour.

Man-hours of labor on construction, over 100,000.

Two men from Montana Power who contributed much to the meeting arrangements for Montana Chapter IAEI, Cecil Kirk, electrical engineer, and H. K. Dickinson, chairman of the arrangements committee, Great Falls.



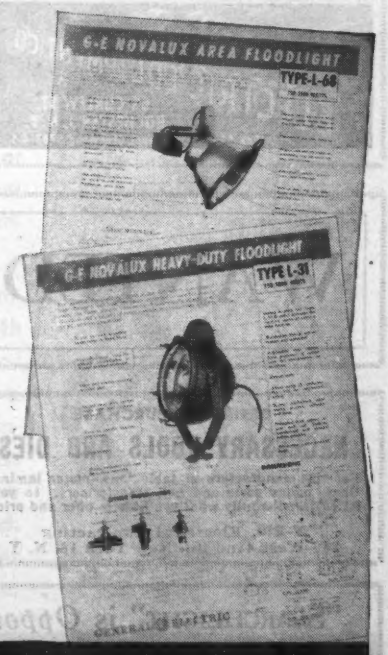
...and get these important advantages

- ★ Proper types and sizes for all applications
- ★ High-efficiency, the result of scientific design
- ★ Long life and low maintenance expense, obtained through sturdy construction
- ★ Expert assistance with application problems, backed up by 30 years' experience
- ★ Convenient sales and service facilities

• WANT THESE HANDY DESCRIPTIVE LEAFLETS FOR YOUR PROPOSALS?

FLOODLIGHT	PUBLICATION
Heavy-duty, steel casing	
200 or 250 watts, Type L-29	GEA-4303
300 or 500 watts, Type L-30	GEA-4304
750 or 1000 watts, Type L-31	GEA-4305
Heavy-duty, cast aluminum	
200 or 250 watts, Type L-38	GEA-4325
General purpose, sheet aluminum	
300 or 500 watts, Type L-49	GEA-4311
750 or 1000 watts, Type L-43	GEA-4310
Sports and area, sheet aluminum	
750 to 1500 watts, Type L-68	GEA-4333
Area, open porcelain enamel	
300 to 1500 watts (Type L-45)	GEA-4433
(Type L-46)	GEA-4432
Handy, sheet aluminum	
200 watts, Type L-66	GEA-4346
Underwater	
100/250/400 watts (Type L-33)	GEA-4438
500/1000/1500 watts (Type L-41)	GEA-4439

Order individually by number, or in sets, from the G-E Apparatus Sales Office or Agent that serves you. Or write General Electric Company, Schenectady 5, N. Y.



GENERAL ELECTRIC

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED —RATES— DISPLAYED

(Not available for equipment advertising)
10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time individual salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions. E.C.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $7.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

New advertisements received by July 23rd appear in August issue, subject to space limitations.

POSITION VACANT

ESTIMATOR-ENGINEER: Age 28 to 40 possessing supervisory and sales ability for well established electrical contracting firm; Chicago-Kansas City district; to estimate wiring jobs large industrial, commercial and institutional buildings. Steady position for right man. Give age, experience, education, salary expected, snapshot and when available. P-342, Electrical Contracting, 520 N. Michigan Ave., Chicago 11, Ill.

REPRESENTATIVE AVAILABLE

WANTED: CONTACT with manufacturers of electrical industrial equipment desirous of representation in New England. Write RA-343, Electrical Contracting, 330 W. 42nd St., New York 18, N. Y.

UNIVERSAL TOOLS

Dandy 8-piece set: CEETEE Pliers, Waterpump Pliers, Master-Ratchet Pipewrench, Needlenose Pliers, Crescent Wrench, Diagonal Cutters, Claw or Pein Hammer, Plastic Screwdriver.—$14.85. "Immediate Shipment." Overnight by Air to Anywhere —USA. Remit with order. Price List and Order Blank Free. Mail Now! If it's Tools: Remember—We have it, Can Get it or it isn't Made.

UNIVERSAL TOOL COMPANY
1527 Grand EC., Kansas City, Mo.

WANTED

DESIRE TO PURCHASE

NECESSARY TOOLS AND DIES

For the manufacture of table fans, motor laminations, motor parts and bell transformers. In your letter describe fully what you have to offer and price.

W-340, Electrical Contracting
330 West 42nd St., New York 18, N. Y.

ALBERT KAHN ASSOCIATED ARCHITECTS & ENGINEERS

needs

ELECTRICAL ENGINEERS
DRAFTSMEN

with experience in

LIGHTING and POWER

for

INDUSTRIAL - COMMERCIAL INSTITUTIONAL BUILDINGS

State Experience and Salary Desired

Applicants must meet
War Manpower Requirements

Address Inquiry to

345 New Center Building
Detroit 2, Michigan

Electrical Engineer —Transformer Design Specialists

Chicago Transformer Manufacturer offers excellent present and postwar position for an electrical engineer who has had transformer design experience on large and small, power, distribution, and air cooled industrial and public utility transformers. This company is fifty years old and is enlarging its manufacturing facilities. Right man has opportunity of establishing lifetime connection with exceptional future and high salary. Communicate in writing, giving experience, etc. We will arrange for personal interview at our expense. All replies will be kept strictly confidential.

Write
P-341, Electrical Contracting
520 North Michigan Ave., Chicago 11, Ill.

"SEARCHLIGHT" is *Opportunity Advertising* . . .

1—to help you find what you want.
2—to help you sell what you no longer need.
For every business want THINK "SEARCHLIGHT" FIRST

Safety in the Operating Room [FROM PAGE 74]

remedy we might be justified in continuing on with the equipment now being used in most hospitals. However, should you be called upon to explain to the relatives saddened by one of these so-called unfortunate occurrences, how could you tell them that even though there are definite means today of alleviating the hazard through the use of proper precautions and equipment, it is considered unwise to spend the money and effort to make the necessary changes because explosions are not very frequent.

As you will note from the table of gaseous anesthetics, all excepting chloroform and nitrous oxide are highly combustible. Chloroform, while commonly used during the past, has lost favor and is seldom used today largely because of the effect it has upon the lungs. Most surgeons will agree that deaths resulting from post operative pneumonia are more numerous than those resulting from explosions, hence the decline in the use of chloroform. Nitrous oxide, commonly known as laughing gas, is seldom used by itself to induce anesthesia for operations of any consequence as its anesthetic effect is not as complete as may be thought necessary.

Possibly some one will eventually discover a gaseous anesthetic which will not be combustible and will still produce complete anesthesia without injury to the patient, but until that is accomplished, and we have every reason to believe that day a long way off, we shall have to use combustible gases of the present hydrocarbon family.

Mixtures of these gases with air, oxygen or nitrous oxide become explosive when the percentages involved fall within the limits as shown in the table; therefore, if the mixture is richer or leaner than the figures shown, it will not explode. The sad part of it is that during every anesthesia it is necessary for the mixture of gases within the patient's lungs to pass completely through their explosive ranges twice, once at the start and again after the operation has been completed. Then too some mixtures stay near the upper limits of their explosive range during the anesthesia as a patient under an anesthetic must be given as much oxygen as his body normally requires. Most of the larger hospitals now use closed rebreathing apparatus with cylinders of compressed oxygen, nitrous oxide, ethylene, cyclopropane, carbon-dioxide and helium connected through a manifold chamber which

supplies automatically various predetermined mixtures of the gases through a rubber tube to a face mask adapted to fit over the patient's face. Mixtures exhaled are passed through a rubber tube to a device which absorbs the carbon-dioxide and then to a rebreathing bag from where it is returned to the face mask. Obviously if the face mask fits well little gas is lost into the room, but that cannot be counted on. In many of the smaller hospitals less intricate equipment is used. In fact in some, ether is still being administered with the old-fashioned drip cone method with the vapors exhaled into the room. As you have already noted, the weight of ethylene is so near that of the air that it may gather in the least expected places once it has escaped. Explosions have occurred in the unapproved types of surgical lamps supported from the ceiling over the operating room table and even in the electric clock cabinets. Mixtures of ethylene, nitrous oxide and oxygen are used more often than any other type of gaseous anesthetic as a general rule, but it is not uncommon to find individual cases where some other mixture is preferred or where no gaseous anesthesias are used at all. Some of the best equipped hospitals are using cyclopropane and oxygen mixtures practically exclusively for major operations and cyclopropane gas is the bad boy of the lot as it is very unstable, being a ring compound.

Many different ideas have been tried to reduce the number of accidents, some of which offer only a sense of false security to the staff. Statistics indicate that the ignition of these gases by electrostatic spark discharge is a hazard of approximately the same frequency of occurrence as ignition by an improper electrical installation, and the two causes are responsible for a very large percentage of the total number of these accidents and the correction of both is up to the electrical contractor.

There are, of course, many details concerning both the purchase of proper supplies, apparatus and equipment for use in hospital operating rooms, and the training of the hospital personnel that are not covered by either this article or the complete standards as it appears unwise at this time to formulate more rigorous recommendations. Undoubtedly the best precaution that any hospital can take is to thoroughly acquaint their personnel with the facts concerning the dangerous character of the gaseous anesthetics and the need for complying not only with the present recommendations but also with additional ones that will be adopted from time to time by the medical profession.

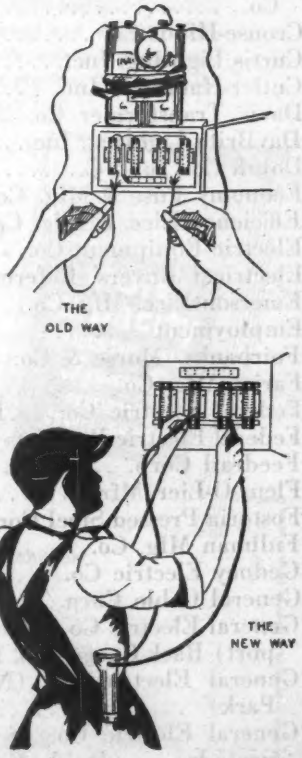
BUZZER TYPE CIRCUIT TESTER

The Auth Buzzer Type Circuit Tester is a modern version of the old, familiar, electrician's test set—a pair of dry cell batteries and a door bell, strapped together, with two wire leads extending.

Like its predecessor, the new circuit tester is intended for use in pairing cables, checking fuses and lamps, and making tone and continuity tests. It may be used for testing all types of circuits of low resistance for open or closed condition and various other applications. It should not be used on live or energized circuits.

Unlike its predecessor, the new unit is streamlined in a slim, phenolic flashlight case with slide type cutoff switch and utility clip for fastening to the belt. It is equipped with a high pitch finest grade buzzer, 48" flexible insulated leads with test prods, and a canvass bag to enclose the complete instrument. Two standard size "D" flashlight cells are utilized.

See your Wholesaler for prices—and ask for information on the complete Auth Line.



AUTH ELECTRICAL SPECIALTY CO., Inc.
422 E. 53rd St., New York 22, N. Y.
Offices in principal cities

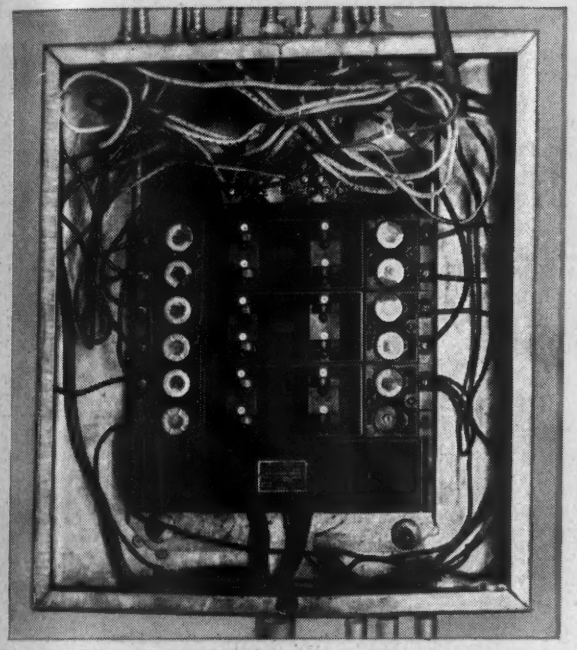
Advertising in This Issue

*Adam Electric Co., Frank... 43
*Aerovox Corporation 160
*Allen-Bradley Co.....117, 118
*Allen Co., Inc., L. B..... 202
*Allis-Chalmers Mfg. Co.... 5
*All-Steel-Equip Co. 32
Aluminum Co. of America.. 157
*American Transformer Co... 39
*Anaconda Wire & Cable Co. 56
*Appleton Electric Co..... 2
Armstrong Mfg. Co..... 202
Arrow-Hart & Hegeman Elec. Co. 29
*Austin Co., M. B..... 38
*Auth Electrical Specialty Co. 205
Automatic Elec. & Mfg. Co... 198
*Baldor Electric Co..... 152
*Beaver Pipe Tools, Inc..... 115
Bell Sound Systems, Inc.... 152
*Benjamin Electric Mfg. Co. 96
*Biddle Co., James G..... 177
Blackhawk Mfg. Co..... 168
Brach Mfg. Corp., L. S..... 184
*Briegel Method Tool Co..... 114
Bryant Electric Co..... 26
*BullDog Electric Products Co. 86
Century Electric Co..... 101
*Champion Lamp Works.... 175
Circo Products Co..... 189
*Collyer Ins. Wire Co..... 191
Crescent Ins. Wire & Cable Co. 119
*Crocker-Wheeler Elec. Mfg. Co. 120
Crouse-Hinds Co. 11
Curtis Lighting, Inc..... 150
Cutler-Hammer, Inc. 122
Davis Transformer Co..... 164
*DayBrite Lighting, Inc..... 128
Dolph Co., John C..... 102
Economy Fuse & Mfg. Co... 12
*Efficiency Elec. & Mfg. Co... 115
Electric Equipment Co..... 204
Electrical Buyers' Reference 46
Emerson Elec. Mfg. Co..... 123
Employment 204
*Fairbanks, Morse & Co..... 165
Faries Mfg. Co..... 166
Federal Electric Co.....126, 127
Federal Electric Products Co. 130
*Feedrail Corp. 195
Fleur-O-Lier Mfrs. 30, 31
Fostoria Pressed Steel Corp.92, 93
*Fullman Mfg. Co..... 197
*Gedney Electric Co..... 184
General Cable Corp.....146, 147
*General Electric Co. (Bridgeport) Back Cover, 156, 173, 179
*General Electric Co. (Nela Park) 40, 41
*General Electric Co. (Schenectady) ....Inside Front Cover....6, 7, 8, 9, 21, 23, 203
General Luminescent Corp.. 176
Goodrich Electric Co..... 134
*Graybar Electric Co..... 58
*Greenlee Tool Co..... 181
Guth Co., Edwin F..... 186
Hall Lamp Co., C. M..... 144
*Hazard Ins. Wire Works Div. 82
Holdenline Company 142
*Hullhorst Micro Tool Co. (Div. of Toledo Standard Comm. Co.) 176
*Ideal Commutator Dresser Co. 49
*Ilg Electric Vent. Co..... 154
*Illinois Electric Porcelain Co. 48
*Ilsco Copper Tube & Products Co. 198
*Irvington Varnish & Ins. Co. 4
*Jefferson Electric Co..... 90
Jenkins Brothers 54
*Johnson Bronze Co..... 113
Joleco Corporation 36
*Kato Engineering Co..... 196
*Killark Elec. Mfg. Co..... 13
Kirkland Co., H. R..... 202
*Klein & Sons, Mathias..... 187
Kondu Corp. 194
*Leader Elec. Mfg. Corp..... 17
Leland Electric Co..... 45
Master Vibrator Co..... 180
*McGill Mfg. Co..... 132
McGraw-Hill Book Co. 180, 196, 200
*Mercoid Corp. 170
*Metropolitan Device Corp... 1
Miller Co. 135
*Minerallac Electric Co..... 202
Mines Equipment Co..... 192
Mitchell Mfg. Co..... 139
Monarch Fuse Co..... 171
Multi Electric Mfg. Co..... 194
*M & W Electric Mfg. Co..... 116
National Elec. Products Corp. 159
*National Varnished Prod. Corp. 105
*North American Electric Lamp Co. 194
*Okonite Co. 82
*Onan & Sons, D. W..... 174
Overbagh & Ayres Mfg. Co.. 183
*Paine Co., The..... 116
Paragon Electric Co..... 193
*Paranite Wire & Cable Corp. 103
Pass & Seymour, Inc..... 184
*Penn-Union Elec. Corp..... 190
Pittsburgh Reflector Corp.. 44
Plastic Wire & Cable Corp... 10
Porcelain Group 48
*Porcelain Products, Inc...48, 158
Pryne & Co..... 188
Pyle-National Co., The..... 182
Radio Corp. of America.42, 140
*Rapid Electroplating Process, Inc. 200
Reading Electric Co., Inc... 174
*Reliance Automatic Lighting, Inc. 178
Republic Steel Corp.....18, 19
*Revere Elec. Mfg. Co..... 200
*Ridge Tool Co..... 34
Rittenhouse Co., A. E..... 172
*RLM Standards Inst., Inc... 133
Robertson Co., H. H..... 27
*Roebling's Sons Co., John A. 106, 107
Royal Electric Co..... 185
*Rusgreen Mfg. Co..... 202
*Russell & Stoll Co..... 111
*Sangamo Electric Co..... 28
Searchlight Section 204
*Sherman Mfg. Co., H. B.... 201
Simplex Wire & Cable Co... 47
*Solar Mfg. Co..... 196
*Sorgel Electric Co..... 199
*Spang-Chalfant 33
*Specialty Porcelain Works.. 48
Square D Company Inside Back Cover
Steel & Tubes Division..18, 19
*Sticht Co., Herman H..... 186
Stockwell Transformer Corp. 164
*Superior Carbon Prod. Co., Inc. 114
Superior Ins. Tape Co..... 25
Superior Instrument Corp... 198
*Sylvania Electric Products, Inc. 81
Talk-A-Phone Mfg. Co..... 170
*Thermador Elec'l. Mfg. Co.. 35
Thomas & Betts..... 15
*Toledo Pipe Threading Mach. Co..... 24
*Toledo Standard Commutator Co. 176
*Tork Clock Co., Inc..... 202
Trico Fuse Mfg. Co..... 113
*Trumbull Electric Mfg. Co.. 16
Union Insulating Co..... 178
*Unistrut Products Co..... 153
*United States Rubber Co. 88, 162
United States Treasury Dept. 167
*Universal Clay Products Co. 48
Universal Tool Company... 204
Wagner Electric Corp..... 109
Wakefield Brass Co., F. W. 161
Walker Brothers, Inc..... 22
*Ware Brothers, Inc..... 112
Western Electric Co..... 198
*Westinghouse Electric Corp. (East Pittsburgh)..50, 51, 84, 94, 125
*Westinghouse Electric Corp. (Lamp Div.) 136, 137
*Westinghouse Electric Corp. (Lighting Div.) 131
*Westinghouse Electric Corp. (Pittsburgh) 37
*Weston Electrical Inst. Corp. 148
*Wheeler Reflector Co..... 138
Where To Buy..... 202
Wiremold Company 20
Wodack Elec. Tool Corp.... 202
Youngstown Sheet & Tube Co. 14

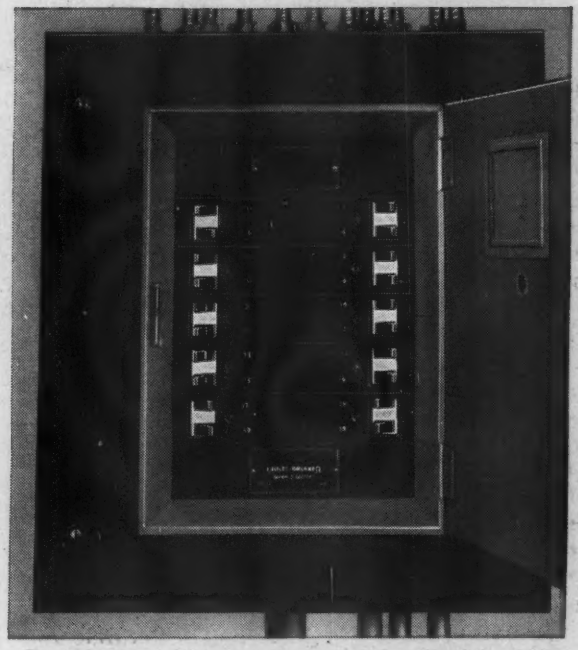
***These companies have included Briefalogs, containing additional buying information on their products, in the 1945 Edition of the Electrical Buyers' Reference.**

66⅔% More Capacity

THROUGH THIS SPEEDY SQUARE D CONVERSION PLAN



• Here was an obsoleted, overloaded panelboard with 12 lighting and power circuits. Could the number of circuits be increased without removing the existing box or adding conduit? Yes, and at the right is the result!



• The old trim and interior were removed and existing wiring pulled out. By rewiring with thin-wall wire, existing conduit could be used. The new Multi-breaker interior provides 20 circuits. The changeover required less than 24 hours.

SQUARE D's Conversion Plan modernizes obsolete panelboards—provides extra circuits, requires no extra space. Here are definite results Square D Panelboard Conversion has produced in scores of plants throughout the country:

- **Increases panelboard capacities; adds modern circuit breaker convenience and protection.**
- **Utilizes existing conduits and boxes.**
- **Conserves power previously lost through overloads.**
- **Eliminates the replacement of branch circuit switches, fuses and fuse clips, due to excessive heating.**

Get the complete Panelboard Conversion Plan story from your Square D Field Engineer . . . or mail the coupon for free illustrated booklet showing actual Conversion Plan results.

SEND FOR YOUR FREE COPY OF "more capacity"

Facts, figures, pictures of actual Square D Panelboard Conversions . . . showing you how Square D's Conversion Plan gives you up to 300% more capacity with a minimum of time and labor. Your copy is FREE—mail coupon today!

SQUARE D COMPANY
6060 Rivard Street, Detroit 11, Michigan

C-7

NAME _____

COMPANY _____ TITLE _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES